Oracle® Rdb for OpenVMS

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Oracle® Rdb for OpenVMS

Release Notes

Release 7.2.5.5

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Oracle Rdb Release Notes, Release 7.2.5.5 for OpenVMS

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Contents

Preface

Purpose of This Manual

This manual contains release notes for Oracle Rdb Release 7.2.5.5. The notes describe changed and enhanced features; upgrade and compatibility information; new and existing software problems and restrictions; and software and documentation corrections.

Intended Audience

This manual is intended for use by all Oracle Rdb users. Read this manual before you install, upgrade, or use Oracle Rdb Release 7.2.5.5.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.

Document Structure

This manual consists of the following chapters:

Chapter 1	Describes how to install Oracle Rdb Release 7.2.5.5.
Chapter 2	Describes problems corrected in Oracle Rdb Release 7.2.5.5.
Chapter 3	Describes problems corrected in Oracle Rdb Release 7.2.5.4.
Chapter 4	Describes problems corrected in Oracle Rdb Release 7.2.5.3.
Chapter 5	Describes problems corrected in Oracle Rdb Release 7.2.5.2.
Chapter 6	Describes problems corrected in Oracle Rdb Release 7.2.5.1.
Chapter 7	Describes problems corrected in Oracle Rdb Release 7.2.5.0.
Chapter 8	Describes enhancements introduced in Oracle Rdb Release 7.2.5.5.
Chapter 9	Describes enhancements introduced in Oracle Rdb Release 7.2.5.4.
Chapter 10	Describes enhancements introduced in Oracle Rdb Release 7.2.5.3.
Chapter 11	Describes enhancements introduced in Oracle Rdb Release 7.2.5.2.
Chapter 12	Describes enhancements introduced in Oracle Rdb Release 7.2.5.1.
Chapter 13	Describes enhancements introduced in Oracle Rdb Release 7.2.5.0.
Chapter 14	Provides information not currently available in the Oracle Rdb documentation set.
Chapter 15	Describes problems, restrictions, and workarounds known to exist in Oracle Rdb Release 7.2.5.5.

Chapter 1
Installing Oracle Rdb Release 7.2.5.5

This software update is installed using the OpenVMS VMSINSTAL utility.

NOTE

Oracle Rdb Release 7.2 kits are full kits. There is no requirement to install any prior release of Oracle Rdb when installing new Rdb Release 7.2 kits.

1.1 Oracle Rdb on HP OpenVMS Industry Standard 64

The Oracle Rdb product family is available on the HP OpenVMS Industry Standard 64 platform and the OpenVMS AlphaServer platform. In general, the functionality for one platform is available on the other platform. However, certain differences between the platforms may result in minor capability and functionality differences.

The database format for Oracle Rdb Release 7.2 is the same on both I64 and Alpha platforms and databases may be accessed simultaneously from both architectures in a cluster environment. Access to an Oracle Rdb Release 7.2 database from prior Rdb versions (on Alpha or VAX platforms) or from other systems on the network is available via the Oracle Rdb remote database server.

1.2 Requirements

The following conditions must be met in order to install this software:

- This Oracle Rdb release requires the following OpenVMS environments:
  - ♦ OpenVMS Alpha V8.2 to V8.4−x.
  - ♦ OpenVMS Industry Standard 64 V8.2−1 to V8.4−x.
- Oracle Rdb must be shutdown before you install this update kit. That is, the command file SYS$STARTUP:RMONSTOP72.COM should be executed before proceeding with this installation. If you have an OpenVMS cluster, you must shutdown the Rdb Release 7.2 monitor on all nodes in the cluster before proceeding.
- After executing RMONSTOP72.COM, no process on any system in the cluster should have any existing RDMSHRP72.EXE image activated. See Section 1.2.1 for additional information.
- The installation requires approximately 280,000 blocks for OpenVMS Alpha systems.
- The installation requires approximately 500,000 blocks for OpenVMS I64 systems.
- The following OpenVMS Mandatory Update from HP needs to be installed on Itanium 8.4 systems before installing this kit: VMS84I_MUP−V0500. A reboot is required after the MUP is installed. The problem description for this fix is: The OpenVMS OTS library string comparison routines OTS$STRCMP_LSSP and OTS$STRCMP_LEQP might return inaccurate results when used with specific string patterns.
  This Mandatory Kit has the following dependencies:
  - ♦ VMS84I_SYS−V0300
  - ♦ VMS84I_UPDATE−V0800
  - ♦ VMS84I_PCSI−V0400

  Please contact your HP Support Representative if you have questions or need more information about these updates.
- Oracle strongly recommends that all available OpenVMS patches are installed on all systems prior to installing Oracle Rdb. Contact your HP support representative for more information and assistance.

1.2.1 Ensure No Processes Have RDMSHRP Image Activated

The Oracle Rdb installation procedure checks to make sure that the Oracle Rdb Monitor (RDMMON) process is not running. However, it is also important to make sure that there are no processes on the cluster that share the system disk that have image activated a prior version RDMSHRP image. Such processes may not be currently attached to a database but may do so in the future and could cause problems by using an older RDMSHRP image with a later Rdb installation.

The following command procedure can be used on each cluster node that shares the system disk to determine if there are any processes that have activated the RDMSHRP72.EXE image. This procedure should be executed by a privileged account after RMONSTOP72 has been run. Any processes that have RDMSHRP72.EXE activated at this point should be terminated prior to starting the Rdb installation procedure.

```
$ DEFINE /NOLOG /USER RDB$TMP 'RDB$TMP
$ ANALYZE /SYSTEM
    SET OUTPUT RDB$TMP
    SHOW PROCESS /CHANNELS ALL
```

```
    EXIT
$ SEARCH /OUTPUT='RDB$TMP' 'RDB$TMP';-1 RDMSHRP72.EXE,"PID:"
$ SEARCH 'RDB$TMP' RDMSHRP72.EXE /WINDOW=(1,0)
$ DELETE /NOLOG 'RDB$TMP';*
```

In the following example, the process 2729F16D named "FOO$SERVER" has the image RDMSHRP72.EXE activated even after RMONSTOP72.COM has been executed and this process is terminated prior to starting the Rdb installation procedure:

```
$ @SYS$STARTUP:RMONSTOP72.COM
   .
   .
   .
$ @FIND_RDMSHRP72_PROC.COM

OpenVMS system analyzer

Process index: 016D   Name: FOO$SERVER  Extended PID: 2729F16D
 0240  7FEF4460 8384F300 $1$DGA2:[VMS$COMMON.SYSLIB]RDMSHRP72.EXE;722

$ STOP/IDENTIFICATION=2729F16D
```

1.3 Intel Itanium Processor 9300 "Tukwila" Support

For this release of Oracle Rdb on HP Integrity servers, the Intel Itanium Processor 9300 series, code named "Tukwila", is the newest processor supported.

1.4 Maximum OpenVMS Version Check

OpenVMS Version 8.4−x is the maximum supported version of OpenVMS for this release of Oracle Rdb.

The check for the OpenVMS operating system version and supported hardware platforms is performed both at installation time and at runtime. If either a non−certified version of OpenVMS or hardware platform is detected during installation, the installation will abort. If a non−certified version of OpenVMS or hardware platform is detected at runtime, Oracle Rdb will not start.

1.5 Database Format Changed

The Oracle Rdb on−disk database format is 721. An RMU /CONVERT operation is required for databases created by or accessed by Oracle Rdb V7.0 or V7.1 to be accessed with Rdb Release 7.2.

Prior to upgrading to Oracle Rdb Release 7.2 and prior to converting an existing database to Oracle Rdb Release 7.2 format, Oracle strongly recommends that you perform a full database verification (with the "RMU /VERIFY /ALL" command) along with a full database backup (with the "RMU /BACKUP" command) to ensure a valid and protected database copy.

1.6 Using Databases from Releases Earlier than V7.0

You cannot convert or restore databases earlier than the Oracle Rdb V7.0 format directly to Oracle Rdb V7.2 format. The RMU Convert command for Oracle Rdb V7.2 supports conversions from Oracle Rdb V7.0 and V7.1 format databases only. If you have an Oracle Rdb V3.0 through V6.1 format database or database backup, you must convert it to at least Oracle Rdb V7.0 format and then convert it to Oracle Rdb V7.2 format. For example, if you have a V4.2 format database, you must convert it first to at least Oracle Rdb V7.0 format, then convert it to Oracle Rdb V7.2 format.

If you attempt to convert or restore a database that is prior to Oracle Rdb V7.0 format directly to Oracle Rdb V7.2 format, Oracle RMU generates an error.

1.7 Invoking the VMSINSTAL Procedure

The installation procedure for Oracle Rdb has been simplified as compared with prior Oracle Rdb major releases. All Oracle Rdb components are always installed and the number of prompts during the installation has been reduced. The installation procedure is the same for Oracle Rdb for OpenVMS Alpha and Oracle Rdb for OpenVMS I64.

To start the installation procedure, invoke the VMSINSTAL command procedure as in the following examples.

- To install the Oracle Rdb for OpenVMS I64 kit that is performance targeted for I64 platforms:

```
@SYS$UPDATE:VMSINSTAL RDBV72550IM device−name
```

- To install the Oracle Rdb for OpenVMS Alpha kit that is compiled to run on all Alpha platforms:

```
@SYS$UPDATE:VMSINSTAL RDBV72550AM device−name
```

- To install the Oracle Rdb for OpenVMS Alpha kit that is performance targeted for Alpha EV56 and later platforms:

```
@SYS$UPDATE:VMSINSTAL RDBV72551AM device−name
```

device−name

Use the name of the device on which the media is mounted. If the device is a disk−type drive, you also need to specify a directory. For example: *DKA400:[RDB.KIT]*

1.8 Stopping the Installation

To stop the installation procedure at any time, press Ctrl/Y. When you press Ctrl/Y, the installation procedure deletes all files it has created up to that point and exits. You can then start the installation again.

If VMSINSTAL detects any problems during the installation, it notifies you and a prompt asks if you want to continue. You might want to continue the installation to see if any additional problems occur. However, the copy of Oracle Rdb installed will probably not be usable.

1.9 After Installing Oracle Rdb

This update provides a new Oracle TRACE facility definition for Oracle Rdb. Any Oracle TRACE selections that reference Oracle Rdb will need to be redefined to reflect the new facility version number for the updated Oracle Rdb facility definition, "RDBVMSV7.2".

If you have Oracle TRACE installed on your system and you would like to collect for Oracle Rdb, you must insert the new Oracle Rdb facility definition included with this update kit.

The installation procedure inserts the Oracle Rdb facility definition into a library file called EPC$FACILITY.TLB. To be able to collect Oracle Rdb event−data using Oracle TRACE, you must move this facility definition into the Oracle TRACE administration database. Perform the following steps:

1. Extract the definition from the facility library to a file (in this case, RDBVMS.EPC$DEF).

```
$ LIBRARY /TEXT /EXTRACT=RDBVMSV7.2 −
_$ /OUT=RDBVMS.EPC$DEF SYS$SHARE:EPC$FACILITY.TLB
```

2. Insert the facility definition into the Oracle TRACE administration database.

```
$ COLLECT INSERT DEFINITION RDBVMS.EPC$DEF /REPLACE
```

Note that the process executing the INSERT DEFINITION command must use the version of Oracle Rdb that matches the version used to create the Oracle TRACE administration database or the INSERT DEFINITION command will fail.

1.10 VMS$MEM_RESIDENT_USER Rights Identifier Required

Oracle Rdb Version 7.1 introduced additional privilege enforcement for the database or row cache attributes RESIDENT, SHARED MEMORY IS SYSTEM and LARGE MEMORY IS ENABLED. If a database utilizes any of these features, then the user account that opens the database must be granted the VMS$MEM_RESIDENT_USER rights identifier.

Oracle recommends that the RMU/OPEN command be used when utilizing these features.

1.11 Installation, Configuration, Migration, Upgrade Suggestions

Oracle Rdb Release 7.2 fully supports mixed−architecture clusters for AlphaServer systems and HP Integrity servers.

In certain development environments, it may be helpful to incorporate a VAX system into the AlphaServer systems and HP Integrity servers cluster. While HP and Oracle believe that in most cases this will not cause problems to the computing environment, we have not tested it extensively enough to provide support. It is possible that VAX systems in a cluster may cause a problem with the cluster performance or stability. Should this happen, the VAX systems in the cluster which are causing the difficulty should be removed.

Oracle continues to support mixed architecture clusters of VAX systems and AlphaServer systems with direct database access using Rdb V7.0. Oracle Rdb V7.1 runs natively on Alpha systems and clusters. All Rdb versions include a built−in remote network database server allowing cross−architecture and cross−version application and database access.

All systems directly accessing the same database within a cluster environment must be running an identical version of Oracle Rdb (where the first 4 digits of the version number match; the fifth digit indicating an optimization level is not significant in this requirement). Access from other versions of Oracle Rdb may be accomplished with the built−in remote network database server for cross−version database access.

When moving applications from existing Alpha or VAX configurations to new environments containing Integrity Server systems, there are numerous possible paths depending on the requirements of individual sites. In general, this can be as straightforward as adding a new node to an already existing AlphaServer systems cluster or standalone system, except the node is an HP Integrity server. Table 1−1, Migration Suggestions, considers several possible situations and recommended steps to take.

Table 1−1 Migration Suggestions

Case	You Wish To...	You should...
1	Add an Integrity server to an existing cluster of Alpha servers	1. Verify database(s) using RMU/VERIFY/ALL. 2. Backup database(s) using RMU/BACKUP. 3. Install Rdb 7.2 on Integrity and Alpha nodes. 4. Convert database(s) to the Rdb 7.2 structure level using RMU/CONVERT. 5. Verify database(s) again using RMU/VERIFY/ALL. 6. Backup database(s) using RMU/BACKUP. 7. Access database(s) from Alpha and Integrity directly by specifying database root file

		specification(s) in SQL ATTACH statements.
2	Add an Integrity server to an existing mixed cluster of VAX and Alpha nodes and access an Rdb database from all nodes. Disks used for the database are accessible from all nodes.	1. Verify database(s) using RMU/VERIFY/ALL. 2. Backup database(s) using RMU/BACKUP. 3. Install Rdb 7.2 on Integrity and Alpha nodes. 4. Convert database(s) to the Rdb 7.2 structure level using RMU/CONVERT. 5. Verify database(s) again using RMU/VERIFY/ALL. 6. Backup database(s) using RMU/BACKUP. 7. Access database(s) from Alpha and Integrity nodes directly by specifying database root file specification(s) in SQL ATTACH statements. 8. Access the database from VAX node(s) using the Rdb built−in network server (remote database) by specifying one of the Alpha or Integrity node names in SQL ATTACH statements. 9. After thorough testing, remove VAX nodes from the cluster.
3	Move database(s) to new disks and add an Integrity server to an existing cluster.	1. Use RMU/COPY with an options file to move the database files to the new disks. 2. Follow the steps for case 1 or case 2.
4	Continue to use Rdb primarily from VAX or Alpha nodes using earlier releases. Add an Integrity server for application testing purposes.	1. Install Rdb 7.2 on Integrity node. 2. Access existing database(s) from Integrity node by specifying one of the Alpha or VAX node names in the SQL ATTACH statements. 3. When testing is complete, follow the steps in case 1 or case 2.
5	Add an Integrity server to an existing cluster of Alpha servers or Create a new cluster from an existing stand−alone Alpha server by adding one or more new	1. Verify database(s) using RMU/VERIFY/ALL.

	Integrity servers.	2. Backup database(s) using RMU/BACKUP. 3. Install Rdb 7.2 on Integrity and Alpha nodes. 4. Convert database(s) to the Rdb 7.2 structure level using RMU/CONVERT. 5. Verify database(s) again using RMU/VERIFY/ALL. 6. Backup database(s) using RMU/BACKUP. 7. Access database(s) from Alpha and Integrity directly by specifying database root file specification in the SQL ATTACH statements.
6	Create a new stand−alone Integrity Server system or cluster of Integrity Servers and move database(s) to the new environment.	1. Verify database(s) using RMU/VERIFY/ALL. 2. Install Rdb 7.2 on new system(s). 3. Back up database(s) on the existing cluster using RMU/BACKUP. 4. Copy backup file(s) to the new system (or, if using tape media, make the tapes available to the new system). 5. Restore database(s) on the new system using RMU/RESTORE specifying the location of each database file in an options file. 6. Verify the new database using RMU/VERIFY/ALL.

Refer to the Oracle Rdb documentation set for additional information and detailed instructions for using RMU and remote databases.

Note that database parameters might need to be altered in the case of accessing a database from a larger number of systems in a cluster.

Chapter 2
Software Errors Fixed in Oracle Rdb Release 7.2.5.5

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.5.

2.1 Software Errors Fixed That Apply to All Interfaces

2.1.1 Memory Leak Possible When Using BITMAPPED SCAN Queries

Bug 17834421

In prior releases of Oracle Rdb, applications which performed BITMAPPED SCAN on SORTED RANKED indices might encounter a small memory leak. This allocated but unused memory can accumulate in server processes that ATTACH (CONNECT) and DISCONNECT to many databases over time.

This problem is more obvious in Oracle Rdb Release 7.3.1 because all system tables use SORTED RANKED indices and are queried using BITMAPPED SCAN.

This problem has been corrected in Oracle Rdb Release 7.2.5.5. Memory used by BITMAPPED SCAN is now correctly released upon end of the query.

2.1.2 Dialect SQL99 Does Not Use Max Key Lookup

Bug 18517510

In Oracle Rdb Release 7.2.5.4, the optimizer avoids using "Max key lookup" and "Min key lookup" optimizations if any of these dialects are used: SQL92, SQL99, ORACLE LEVEL1, or ORACLE LEVEL2.

Many customers have queries where the performance benefits of the "Max key lookup" strategy outweigh the theoretical correctness of getting NULL elimination warnings.

For example, the following query applies "Max key lookup" in a MF_PERSONNEL database with SALARY_HISTORY_TEST_IDX defined as sorted ranked but does not use that strategy when using (for example) SET DIALECT 'SQL99'.

```
SQL> CREATE INDEX SALARY_HISTORY_TEST_IDX
cont> ON SALARY_HISTORY (EMPLOYEE_ID, SALARY_START)
cont> TYPE IS SORTED RANKED;
SQL>
SQL> SELECT MAX(SALARY_START)
cont> FROM SALARY_HISTORY
cont> WHERE EMPLOYEE_ID = '00374';
Tables:
  0 = SALARY_HISTORY
Aggregate: 0:MAX (0.SALARY_START)
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_HISTORY_TEST_IDX [1:1]      Max key lookup
    Keys: 0.EMPLOYEE_ID = '00374'

 10-OCT-1982 00:00:00.00
1 row selected
SQL> set dialect 'sql99' ;
SQL> SELECT MAX(SALARY_START)
```

```
cont> FROM SALARY_HISTORY
cont> WHERE EMPLOYEE_ID = '00374';
Tables:
  0 = SALARY_HISTORY
Aggregate: 0:MAX (0.SALARY_START)
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_HISTORY_TEST_IDX [1:1]
    Keys: 0.EMPLOYEE_ID = '00374'

 10-OCT-1982 00:00:00.00
1 row selected
```

There is no workaround for this problem except to avoid the listed dialects when using MIN and MAX optimizations.

These problems have been corrected in Oracle Rdb Release 7.2.5.5.

2.1.3 Wrong Result From a Nested UNION Query With OR Predicate

Bug 18825653

In prior releases of Oracle Rdb, a complex query referencing a view containing a UNION may return the wrong result when an OR predicate is involved in the outer query.

For example, the following query is expected to return some rows and it does not.

```
SELECT C1, C3, C6 FROM Q_VIEW
WHERE C6='20' AND (C3= 'KMT' or C3= 'HFM');
0 rows selected
```

However, if the OR predicate is omitted, the query returns the rows correctly.

```
SELECT C1, C3, C6 FROM Q_VIEW
WHERE C6='20' AND C3= 'KMT';
 C1          C3         C6
 EGP         KMT        20
1 row selected
```

The views are defined as follows:

```
create view Q_VIEW (QC1, QC2, QC3, QC4, QC5, QC6)
as
select (CI.C1, CI.C2, CI.C3, CI.C4, CI.C5, CI.C6)
from CI_VIEW CI,        ! 1 row
     TT1                ! empty table
UNION
select (CI.C1, CI.C2, CI.C3, CI.C4, CI.C5, CI.C6)
from CI_VIEW CI inner join      ! 1 row
     TT2 on (TT2.C1 = CI.C1)    ! 1 row
;

create view CI_VIEW (CI1, CI2, CI3, CI4, CI5, CI6)
as
select (T1.C1, T1.C2, T1.C3, T1.C4, T1.C5,
        CAST('CGS' AS CHAR(3)   ! C6
```

```
        )
from T1 inner join T2           ! empty tables
     on (T1.C1 = T2.C1)
UNION
select (T3.C1, T3.C2, T3.C3, T3.C4, T5.C5,
        CASE WHEN EXISTS (SELECT * FROM T6
                          WHERE T6.C3= T4.C3)
                THEN CAST('EGP' AS CHAR(3))
                ELSE CAST('   ' AS CHAR(3))
            END                         ! C6
from T3 inner join                          ! 1 row
     T4 on (T4.C3 = T3.C3) inner join   ! 1 row
     T5 on (T5.C1 = T3.C1)              ! 1 row
where T3.C7 = 'XXXXX';
```

The key parts of this query which contributed to the error are:

1. The main query selects from a nested UNION view with an OR predicate in the WHERE clause.
2. The main view, Q_VIEW, is a UNION query of two legs where another view, CI_VIEW, is nested within the join.
3. CI_VIEW is also a UNION query where each leg joins another table.
4. The first UNION leg joins an empty table but the second one joins three main tables using inner join. The column C6 of the select clause contains a CASE statement with subselect joining another table.

Currently there is no workaround for this problem.

These problems have been corrected in Oracle Rdb Release 7.2.5.5.

2.1.4 Unexpected Zero Result From COUNT Aggregate

Bug 17908875

In prior releases of Oracle Rdb, it was possible, in rare cases, for the Rdb optimizer to use a dynamic retrieval strategy to solve a COUNT aggregate using more than one SORTED RANKED background index. Depending on the index chosen by the estimation (Estim) phase as the most likely index, it was possible for the COUNT to erroneously return zero when the "Index counts lookup" optimization was used.

The following example shows such a strategy.

```
SQL> SELECT COUNT(*)
cont> FROM SAMPLE
cont> WHERE SAMPLE_BX = 7001
cont> AND SAMPLE_AC = 'Xxxx'
cont> AND SAMPLE_XC = 'Yyyy'
cont> AND SAMPLE_CD = '1234567'
cont> ;
~S#0002
Tables:
  0 = SAMPLE
Aggregate: 0:COUNT (*) Q2
Leaf#01 BgrOnly 0:SAMPLE Card=1492231
  Bool: (0.SAMPLE_BX = 7001) AND (0.SAMPLE_AC = 'Xxxx') AND (
        0.SAMPLE_XC = 'Yyyy') AND (0.SAMPLE_CD = '1234567')
  BgrNdx1 SAMPLE_KEY [3:3] Fan=1
    Keys: (0.SAMPLE_BX = 7001) AND (0.SAMPLE_AC = 'Xxxx') AND (
          0.SAMPLE_CD = '1234567')
```

```
  BgrNdx2 SAMPLE_RANKED_1 [4:4] Fan=51  Index counts lookup
    Keys: (0.SAMPLE_CD = '1234567') AND (0.SAMPLE_BX = 7001) AND (
          0.SAMPLE_XC = 'Yyyy') AND (0.SAMPLE_AC = 'Xxxx')
  BgrNdx3 SAMPLE_RANKED_2 [4:4] Fan=51  Index counts lookup
    Keys: (0.SAMPLE_AC = 'Xxxx') AND (0.SAMPLE_BX = 7001) AND (
          0.SAMPLE_CD = '1234567') AND (0.SAMPLE_XC = 'Yyyy')
~Estim  SAMPLE_KEY Hashed: Nodes=0, Est=4 Precise IO=0
~Estim  SAMPLE_RANKED_1 Ranked: Nodes=1, Min=2, Est=2 Precise IO=1
~Estim  RLEAF Cardinality=  1.4922310E+06
~Estim  SAMPLE_RANKED_2 Ranked: Nodes=1, Min=2, Est=2 Precise IO=1
~E#0002.01(1) Estim   Index/Estimate 2/2 3/2 1/4
~E#0002.01(1) BgrNdx2 EofData  DBKeys=0  Fetches=0+0  RecsOut=0 #Bufs=0

           0
1 row selected
SQL>
```

For such a strategy to be used, multiple SORTED RANKED indices must include leading segments that match the query criteria specified by the WHERE clause.

This problem can be avoided by using SET FLAGS 'NOCOUNT_SCAN' prior to executing this query, either as a dynamic statement or by defining the logical name RDMS$SET_FLAGS.

This problem has been corrected in Oracle Rdb Release 7.2.5.5. Oracle Rdb now supports multiple SORTED RANKED indices for use with *Index counts lookup* optimization as part of a dynamic query strategy. In addition, the STRATEGY display now includes added notation to show that *Index counts lookup* optimization was used.

2.1.5 Inner Join Query With NOT LIKE Predicate Slows Down

Bug 18081992

In prior releases of Oracle Rdb, an inner join query using a predicate with a NOT operator may slow down when using Cross strategy. Note that in this example, the NOT LIKE operation is transformed to a NOT STARTING WITH operation.

The problem is caused by the NOT operator during the costing as a Cross join. With the fix, the strategy is switched to a Match join by disabling the transitivity in such cases.

For example, the following query may run for an extended time.

```
SELECT count(*)
FROM (
       SELECT
              T1.DEV_ID,
              T1.OPER_ID,
              T1.OPER_SEQ_NO,
              T1.STEP_ID
       FROM T1
       WHERE (((T1.STEP_ID)<>'------'))
      ) stp
    INNER JOIN T2
      ON stp.OPER_ID = T2.OPER_ID
    where
```

```
        stp.OPER_ID Not Like 'WC%' and
        T2.STEP_ID Like 'PP%'
    ;
Tables:
  0 = T1
  1 = T2
Aggregate: 0:COUNT (*) Q2
Cross block of 2 entries  Q2
  Cross block entry 1
    Leaf#01 NdxOnly 1:T2 Card=123039
      Bool: 1.STEP_ID STARTING WITH 'PP'
      FgrNdx  T2_NDX1 [0:0] Fan=12
      BgrNdx1 T2_NDX2 [1:1] Fan=15
        Keys: 1.STEP_ID STARTING WITH 'PP'
  Cross block entry 2
    Conjunct: 0.OPER_ID = 1.OPER_ID
    Merge of 1 entries  Q2
      Merge block entry 1  Q3
      Conjunct: NOT (0.OPER_ID STARTING WITH 'WC')
      Leaf#02 BgrOnly 0:T1 Card=158894
        Bool: 0.STEP_ID <> '------'
        BgrNdx1 T1_IDX [0:0] Fan=11
          Bool: (NOT (0.OPER_ID STARTING WITH 'WC')) AND (NOT (0.OPER_ID
                 STARTING WITH 'WC')) AND (0.STEP_ID <> '------')
```

The query runs fast if transitivity is disabled, which uses a Match strategy. When executing the same query as before, you can see the altered strategy which leads to a reduced execution time.

```
Tables:
  0 = T1
  1 = T2
Aggregate: 0:COUNT (*) Q2
Conjunct: 0.OPER_ID = 1.OPER_ID
Match  Q2
  Outer loop
  Match_Key:0.OPER_ID
    Sort: 0.OPER_ID(a)
    Merge of 1 entries  Q2
      Merge block entry 1  Q3
      Conjunct: NOT (0.OPER_ID STARTING WITH 'WC')
      Leaf#01 BgrOnly 0:T1 Card=158894
        Bool: 0.STEP_ID <> '------'
        BgrNdx1 T1_IDX [0:0] Fan=11
          Bool: (NOT (0.OPER_ID STARTING WITH 'WC')) AND (0.STEP_ID <>
                '------')
  Inner loop      (zig-zag)
  Match_Key:1.OPER_ID
  Index_Key:OPER_ID, STEP_ID
    Conjunct: 1.STEP_ID STARTING WITH 'PP'
    Index only retrieval of relation 1:T2
      Index name  T2_IDX1 [0:0]
        Bool: 1.STEP_ID STARTING WITH 'PP'

      172849
1 row selected
```

A workaround may be to disable transitivity using the SET FLAGS 'NOTRANSITIVITY' statement.

This problem has been corrected in Oracle Rdb Release 7.2.5.5.

2.1.6 Unable to Call External Routine When Attached Remotely to a Database

Bug 13640883

When an external routine which uses SQL statements, attached to the same database that was remotely accessed, then it would fail with an error −RDB−E−INVALID_SEC_INF, invalid security information. For example:

```
SQL> attach 'filename remhst"username password"::mydb';
SQL> declare :syu, :ssu, :cru rdb$object_name = '';
SQL> declare :sc int = 0;
SQL> begin
cont> call show_user (:sc, :syu, :ssu, :cru);
cont> trace 'sqlcode −> ', :sc;
cont> if :sc < 0
cont> then
cont>     call sql_signal ();
cont> end if;
cont> end;
%RDB−E−EXTFUN_FAIL, external routine failed to compile or execute successfully
−RDMS−E−RTN_ERROR, routine "SQL_SIGNAL" generated an error during execution
−RDB−E−INVALID_SEC_INF, invalid security information
SQL>
```

A workaround would be to include explicit USER/USING clauses in the external routine to attach to the local database.

This problem has been corrected in Oracle Rdb Release 7.2.5.5.

2.2 SQL Errors Fixed

2.2.1 Unexpected Bugcheck When Using NUMBER OF SWEEP ROWS Clause

Bug 18187722

In prior releases of Oracle Rdb, the clause NUMBER OF SWEEP ROWS was accepted as part of the ROW CACHE IS ENABLED clause. This would cause SQL to generate a bugcheck dump.

The following example shows the problem in ALTER DATABASE.

```
SQL> CREATE DATABASE
cont>     FILENAME 'SAMPLE.RDB'
cont>     ROW CACHE ENABLE
cont> ;
SQL> ALTER DATABASE
cont>     FILENAME 'SAMPLE.RDB'
cont>     ROW CACHE ENABLE
cont>           (NUMBER OF SWEEP ROWS IS 500);
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]SQLBUGCHK.DMP;
%SQL-F-BUGCHK, There has been a fatal error. Please contact your Oracle
support representative. walk_alter_dbase - bad RC option
SQL>
```

A similar error occurs during CREATE DATABASE.

```
SQL> CREATE DATABASE
cont>     FILENAME 'SAMPLE.RDB'
cont>     ROW CACHE ENABLE
cont>           (NUMBER OF SWEEP ROWS IS 500
cont>           ,SWEEP INTERVAL IS 60 SECONDS);
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]SQLBUGCHK.DMP;
%SQL-F-BUGCHK, There has been a fatal error. Please contact your Oracle
support representative. walk_create_dbase - bad RC option
```

This clause is only applicable to the CREATE CACHE, ALTER CACHE or ADD CACHE clauses and should not have been accepted or documented for CREATE DATABASE statement, ALTER DATABASE statement or IMPORT Statement.

This problem has been corrected in Oracle Rdb Release 7.2.5.5.

2.2.2 Unexpected -RDMS-F-ACTQUERY Error During ALTER TABLE

Bug 13738014

In prior releases of Oracle Rdb, an ALTER TABLE statement might fail if a DEFAULT clause referenced a SQL function that also referenced the table being altered. The following example shows the reported error.

```
create table T
```

```
    (id integer
    );

create module M
    function MAX_ID ()
    returns integer;
    return (select max (id) from T) + 1;
end module;

alter table T
    add column ID2 integer default MAX_ID();
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-F-ACTQUERY, there are queries compiled that reference relation "T"
-RDMS-F-RELNOTCHG, relation T has not been changed
```

This problem may occur for ALTER TABLE ... ALTER COLUMN or ALTER TABLE ... ADD COLUMN clauses.

This problem has been corrected in Oracle Rdb Release 7.2.5.5. SQL now avoids loading the referenced function when checking the return result type of the referenced function. This also means that nested routines are no longer loaded.

2.2.3 Unexpected SQL Bugcheck With Malformed INSERT or UPDATE Column Target

Bug 18848877

In prior releases of Oracle Rdb, SQL would bugcheck if the target of an INSERT or UPDATE was erroneously coded as a sequence reference (either CURRVAL or NEXTVAL).

The following example shows the problem.

```
SQL> insert into X (y.nextval) values (0);
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTER]SQLBUGCHK.
%SQL-F-BUGCHK, There has been a fatal error. Please contact your Oracle support
SQL> update X set y.nextval = 0;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTER]SQLBUGCHK.
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual address=000000000000
```

This problem has been corrected in Oracle Rdb Release 7.2.5.5. SQL now correctly diagnoses these problems. The following output from the SQL Module Language compiler shows the new diagnostics.

```
insert into X (y.currval) values (1);
               1
%SQL-F-INVCOLREF, (1) Invalid column reference for INSERT or UPDATE statement
update X set y.nextval = 0;
             1
%SQL-F-INVCOLREF, (1) Invalid column reference for INSERT or UPDATE statement
```

2.3 RMU Errors Fixed

2.3.1 RMU Unload Not Generating Oracle Style INTERVAL DAY Values

Bug 18262460

In prior versions of Oracle Rdb, the RMU Unload command, when requested to generate a CONTROL file format for processing by the sqlldr tool, would not generate INTERVAL DAY values acceptable by the Oracle Database.

This problem has been corrected in Oracle Rdb Release 7.2.5.5. RMU Unload now implicitly establishes the DIALECT as ORACLE LEVEL2 (see SET DIALECT Command for more details). This dialect causes Oracle Rdb to use an ASCII space character to separate the DAY field from the following HOUR field.

In addition, RMU Unload also transforms the following types to be compatible with the Oracle Database.

- DATE VMS is unloaded as TIMESTAMP(2).
  This allows fractional second values (100th of a second) to be unloaded. In prior releases, this type was unloaded as a DATE with fractional second values truncated.
- INTERVAL YEAR and INTERVAL MONTH types are unloaded as INTERVAL YEAR(9) TO MONTH.
- INTERVAL DAY, INTERVAL HOUR, INTERVAL MINUTE, INTERVAL SECOND, INTERVAL DAY TO HOUR, INTERVAL DAY TO MINUTE, INTERVAL HOUR TO MINUTE, INTERVAL HOUR TO SECOND, INTERVAL MINUTE TO SECOND are unloaded as INTERVAL DAY(9) TO SECOND(2).

2.3.2 Full Backup No Longer Required After Altering the Snapshot Area Page Allocation

Bug 18319063

Modifying the Oracle Rdb database snapshot storage area page allocation previously required the next database backup to be a full database backup. If an incremental backup was executed without a preceding full backup following a modification of the snapshot storage area page allocation, the fatal RMU−F−NOFULLBCK error message was output and the incremental backup was aborted.

This restriction has now been removed. When the snapshot storage area page allocation is modified, the incremental backup now succeeds when the incremental backup is executed without a preceding full backup.

The following example shows the previous incorrect behavior. If the next database backup after altering a database storage area snapshot page allocation was not a full backup, the %RMU−F−NOFULLBCK message was output and the backup was aborted.

```
$ SQL
  alter database filename mf_personnel
```

```
  alter storage area jobs snapshot allocation is 100 pages;
  exit
$ rmu/backup/incremental/nolog mf_personnel.rdb -
  DEVICE:[DIRECTORY]mfp.rbf
%RMU-F-NOFULLBCK, no full backup of this database exists
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 28-FEB-2014 06:56:02.11
$
```

The following example shows that this restriction has now been removed. If the next database backup after altering a database storage area snapshot page allocation is an incremental backup, the incremental backup now succeeds.

```
$ SQL
  alter database filename mf_personnel
  alter storage area jobs snapshot allocation is 100 pages;
  exit
$ rmu/backup/incremental/nolog mf_personnel.rdb -
  DEVICE:[DIRECTORY]mfp.rbf
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.5.

Chapter 3
Software Errors Fixed in Oracle Rdb Release 7.2.5.4

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.4.

3.1 Software Errors Fixed That Apply to All Interfaces

3.1.1 Memory Leak Corrected in Queries That Use Sorting

Bug 17360970

In all prior releases of Oracle Rdb, there was a minor memory leak that occurred when a query used sorting (ORDER BY, GROUP BY, DISTINCT, UNION, and so on) and the query was terminated prior to returning all rows. For instance, a cursor was closed (using CLOSE, COMMIT or RELEASE statements) or if the query contained a LIMIT TO clause.

In these cases, the normal cleanup code could fail to release a small piece of virtual memory if an I/O had fetched data from the SORT work files and that buffered data was not returned to the query.

Workarounds to this problem include:

- Avoiding the use of SORT for such queries. For example, creating an index (possibly adding a COLLATING SEQUENCE) which is the correct order for the query. In such cases, the SORT operation can be avoided by using the index ordering.
- Avoid using the disk sorting interface. This can be done by allowing QSORT (an alternate algorithm) to be used for larger sets of data or defining the logical name RDMS$BIND_MAX_QSORT_COUNT to a value adequate to hold all rows input into the sort.
- Restructuring the query so that the LIMIT TO is part of an outer reference and perform the ORDER BY in a nested derived table.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.1.2 Ranked Index Bugchecks − PSII2REMOVEDUPBBC & PSII2INSERTDUPBBC

Bug 17383599

In prior versions of Oracle Rdb, applications trying to insert or remove records using a ranked index might bugcheck with an exception similar to the following:

```
Exception at 00000000xxxxxxxx : RDMSHRP72\PSII2REMOVEDUPBBC + 0000xxxx
%COSI−F−BUGCHECK, internal consistency failure
```

A bugcheck may also be raised with the following exception:

```
Exception at 00000000xxxxxxxx : RDMSHRP72\PSII2INSERTDUPBBC + 0000xxxx
%COSI−F−BUGCHECK, internal consistency failure
```

In addition, the following exception may be raised during record retrieval:

```
%RDMS−F−NODBK, 61:117:29 does not point to a data record
```

This problem may also lead to a corruption to the index on−disk. An RMU VERIFY INDEX of the database will indicate that the index is corrupt with an exception similar to:

```
RMU−E−BADDBKFET, Error fetching dbkey 61:117:29
```

Depending on the transaction mix of insertions and deletions, it is possible that these problems may not cause any on−disk index corruption. The problem may only be a transient error, affecting in−memory structures only.

These problems are more likely to occur when there are a large number of duplicates within the ranked index entries.

A possible workaround is to rebuild the index if RMU/VERIFY has shown an exception similar to the one cited above. The rebuild of the index will rectify any ranked index corruptions. However, in prior versions of Oracle Rdb, the same problem may re−occur on subsequent transactions.

These problems have been corrected in Oracle Rdb Release 7.2.5.4.

3.1.3 Wrong Result Using Match Strategy on EXISTS Subquery

Bug 16819636

In prior releases of Oracle Rdb, the optimizer might return wrong results when the previous aggregate subquery is later joined by a cross with a direct lookup index key, which is part of an equivalent class of transitive equality booleans between multiple table joins.

For example, the following query contains four tables joined with transitive equality booleans between them, followed by an EXISTS subquery joining with another equality boolean transitive to one of the outer tables.

```
SELECT
    t2.active, t2.fdate, t1.id, t1.status
FROM
    T0 t0, T1 t1, T2 t2, T3 t3,
WHERE
    t1.status = 'E'
    AND ( (t3.fdate BETWEEN '20130421' AND '20130810') OR (t3.active='1') )
    AND t3.id=t1.id
    AND EXISTS
      (SELECT * FROM T4 t4 WHERE
          t4.id=t1.id AND t4.type = '1')
    AND t2.id=t1.id
    AND t2.id=t0.id
    AND ((t2.fdate between '20130421' AND '20130810') OR (t2.active='1'))
    AND t0.iso='GB'
;
Tables:
  0 = T0
  1 = T1
  2 = T2
  3 = T3
  4 = T4
Cross block of 4 entries  Q1
  Cross block entry 1
```

```
    Conjunct: 3.ID = 1.ID
    Match  Q1
      Outer loop
        Match_Key:1.ID
        Conjunct: <agg0> <> 0
        Match  Q1
          Outer loop      (zig-zag)
              Match_Key:1.ID
              Index_Key:ID
                Conjunct: 1.STATUS = 'E'
                Get     Retrieval by index of relation 1:T1
                  Index name  T1_IDX [0:0]
              Inner loop      (zig-zag)
              Match_Key:4.ID
              Index_Key:TYPE, ID, FDATE
                Aggregate-F1: 0:COUNT-ANY (<subselect>) Q2
                Index only retrieval of relation 4:T4
                  Index name  T4_IDX [1:1]
                    Keys: T4.TYPE = '1'
      Inner loop      (zig-zag)
        Match_Key:3.ID
        Index_Key:ID, SLID, FDATE
          Conjunct: ((3.FDATE >= '20130421') AND (3.FDATE <=
                      '20130810')) OR (3.ACTIVE = '1')
          Get     Retrieval by index of relation 3:T3
            Index name  T3_IDX [0:0]
  Cross block entry 2
    Index only retrieval of relation 0:T0
      Index name  T0_NDX [2:2]        Direct lookup <== See Note below
        Keys: (4.ID = 0.ID) AND (0.ISO = 'GB')
  Cross block entry 4
    Leaf#01 FFirst 2:T2 Card=32
      Bool: (2.ID = 1.ID) AND (2.ID = 0.ID) AND (((2.FDATE >= '20130421'
            ) AND (2.FDATE <= '20130810')) OR (2.ACTIVE = '1'))
      BgrNdx1 T2_IDX [1:1] Fan=11
        Keys: 2.ID = 1.ID
...etc...

0 rows selected   <= wrong result returned
```

The wrong result is caused by the index boolean "(4.ID = 0.ID)" in the keys for the direct lookup index T0_NDX under the "Cross block entry 2".

A workaround may be to use a query outline to change the join order.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.1.4 Bugcheck from RMU/VERIFY/ALL After Constraint Verification

Bug 17548158

In prior releases of Oracle Rdb, the RMU Verify command might fail with a bugcheck on a CHECK constraint similar to the example below.

```
check ((not col1 in (' ', NULL)))
```

If the IN clause does not contain NULL, then no bugcheck occurs.

In fact, the coding for this constraint is in error and does not achieve the expected behavior. A corrected version is shown here.

```
check ((col1 <> ' ' and col1 is not NULL))
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.1.5 Bugcheck at DIOFETCH$FETCH_SNAP_SEG

Bug 8881798

Starting in Oracle Rdb Release V7.2, it was possible for a read−only transaction to bugcheck with an exception at routine DIOFETCH$FETCH_SNAP_SEG. The actual offset within that routine would depend on the current platform and release version number.

For database consistency, if a record is modified on a data page by a read−write (RW) transaction, but not committed prior to the start of a read−only (RO) transaction, those updates should not be visible to that RO transaction. In such a case, the RO transaction would need to find some prior version of the record that would be visible. This prior version is written by a RW transaction to a page in a snapshot file. The data page maintains a pointer to this snapshot page. Transaction Sequence Numbers (TSNs) play an important role in determining which prior copy of a record is visible and when a snapshot page is considered obsolete and re−useable.

The bugcheck occurs when the RO transaction needs to find a prior version of a data record, follows the pointer to one or more snapshot pages, but cannot find a version that is visible. This problem was caused by RW transactions that erroneously re−used valid snapshot pages needed by these RO transactions.

This problem does not cause any data inconsistencies or corruption. Simply restarting the RO transaction should suffice.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.1.6 In Some Cases, System User Audited Instead of Session User

Bug 17731257

In prior releases of Oracle Rdb, it was possible that when auditing actions on database objects, the SYSTEM_USER was recorded instead of the SESSION_USER. This occurred during user impersonation, such as when an application uses CONNECT using USER and USING parameters.

This most commonly occurs when the SESSION_USER is not established for auditing database events. A possible workaround is to enable DACCESS auditing for the DATABASE for at least the SELECT privilege.

```
$ RMU/SET AUDIT/ENABLE=DACCESS=DATABASE/PRIV=(SELECT,ALTER) PERSONNEL
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4. Oracle Rdb now correctly records the session

user in the audit journal.

3.1.7 Using BEGIN/END Around Set Transaction Leads to Memory Leak

Bug 16536178

The following sequence of SQL statements can cause a memory leak in Dispatch and, if run for long enough without disconnecting, could cause the process to run out of memory.

```
BEGIN
  SET TRANSACTION READ WRITE
    RESERVING EMPLOYEES FOR SHARED WRITE;
END;
BEGIN
  COMMIT;
END;
```

Removing at least one BEGIN/END (it doesn't matter which) can avoid the problem.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.1.8 Excessive Alignment Faults on Client Side Using RDB$REMOTE

Bug 18155052

It was possible for the client side of an RDB$REMOTE type of connection to experience excessive alignment faults.

```
Exception PC       Rate  Exception PC         Module      Offset    EPID
-----------------  ----  ---------------------------------------------------
00000000.800F5191  94.95 RDB$SHARE72+8005D191 RDB$SHARE72 8005D191   20E07125
00000000.800F50B0  94.86 RDB$SHARE72+8005D0B0 RDB$SHARE72 8005D0B0   20E07125
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.2 SQL Errors Fixed

3.2.1 Unexpected RDB−E−OBSOLETE_METADA Error During ALTER TABLE

Bug 17361878

In prior releases of Oracle Rdb, the implicit alter of a view definition was not handling missing metadata items correctly. When a COMPUTED BY column of a table or view could not be resolved because of a prior DROP ... CASCADE operation, the value returned for the computed expression should have been NULL. The database administrator should replace the missing object as soon as possible.

The reported problem shows that subsequent ALTER TABLE operations fail when the missing column is referenced. This is shown by this simple example.

```
SQL> create table TEST_TBL
cont>     (c0     bigint
cont>     ,c1     tinyint
cont>     );
SQL>
SQL> insert into TEST_TBL
cont>     values (0, 1);
1 row inserted
SQL>
SQL> alter table TEST_TBL
cont>     add c2
cont>     automatic as −1;
SQL>
SQL> create view TEST_TBL_VIEW
cont>     as select * from TEST_TBL;
SQL>
SQL> alter table TEST_TBL
cont>     drop column c2 cascade;
SQL>
SQL> alter table TEST_TBL
cont>     alter C1 smallint;
%RDB−E−NO_META_UPDATE, metadata update failed
−RDB−E−OBSOLETE_METADA, request references metadata objects that no longer exist
−RDMS−F−BAD_SYM, unknown field symbol − C2
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.2.2 Unexpected RDMS−F−ACTQUERY Query Error From ALTER TABLE ... DROP COLUMN

In prior versions of Oracle Rdb, attempts to use ALTER TABLE to drop a column would fail with an RDMS−F−ACTQUERY error. This occurred because the table being altered was in use by a compiled query, such as a declared cursor. This is normal for the RESTRICT option (the default behavior) but should not happen when using the CASCADE option. When using DROP TABLE ... CASCADE, no such error occurs because Oracle Rdb implicitly invalidates active queries.

The following example shows the reported error.

```
SQL> DECLARE C11332 CURSOR FOR SELECT COUNT(*) FROM CHANGG;
SQL> OPEN C11332;
SQL> DECLARE :INT1 INT;
SQL> FETCH C11332 INTO :INT1;
SQL> CLOSE C11332;
SQL> ALTER TABLE CHANGG DROP AGE CASCADE;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-F-ACTQUERY, there are queries compiled that reference relation "CHANGG"
-RDMS-F-RELNOTCHG, relation CHANGG has not been changed
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4. When the CASCADE option is used, the ALTER TABLE statement invalidates active queries in the same way as the DROP TABLE ... CASCADE statement.

3.2.3 Memory Leak Possible in DESCRIBE Dynamic SQL Statement

Bug 14570971

In prior releases of Oracle Rdb V7.2, it was possible that applications using Dynamic SQL could encounter a small memory leak. Application servers which stayed active for a long time might exhaust available memory. This might affect SQL/Services, JDBC, and so on.

This problem occurs during the DESCRIBE statement when processing any of several special character columns or functions. This includes:

- DBKEY
- ROWID
- the SYS_GUID() function
- the RDB$SECURITY_CLASS system table column
- a column defined using the system domain RDB$DATABASE_KEY
- any COMPUTED BY or AUTOMATIC AS column that uses such value expressions
- and any view column based on any of these value expressions.

These character types use a special character set which is not being handled correctly when building the SQLDA.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.2.4 Changes to Date/Time Literal Processing

- This release of Oracle Rdb improves the diagnostics reported for malformed date/time and interval values.
  In prior versions of Oracle Rdb, a single exception COSI$_IVTIME would be reported if there was a syntax error in the date/time value or if the field values exceeded the allowed range of values.
  The following example shows these additional messages.

  ```
  SQL> select interval'100-100' year to month from rdb$database;
  ```

```
%SQL-F-DATCONERR, Data conversion error for string '100-100'
-COSI-F-IVTIMEILF, invalid interval - leading field has too many digits
SQL> select interval'100-100' year(3) to month from rdb$database;
%SQL-F-DATCONERR, Data conversion error for string '100-100'
-COSI-F-IVTIMEINT, invalid interval - error in the format or values
SQL> select time'12:00:01.999' from rdb$database;
%SQL-F-DATCONERR, Data conversion error for string '12:00:01.999'
-COSI-F-IVTIMEFSP, invalid time or interval - fractional seconds field has too
many digits
SQL>
```

Oracle Rdb now returns SQLSTATE '22015' *Interval field overflow* in some cases where SQLSTATE '22007' *Invalid datetime format* was returned in prior releases.

- Leading zeros for the interval leading field are now ignored when checking the format of literal values. Prior versions of Oracle Rdb would raise an exception even though these were insignificant.

```
SQL> create table TEST (duration interval year(2) to month);
SQL> insert into TEST values (interval'00000'year to month);
%SQL-F-DATCONERR, Data conversion error for string '00000'
-COSI-F-IVTIMEILF, invalid interval - leading field has too many digits
-COSI-F-IVTIME, invalid date or time
```

This example no longer causes an exception.

- This release of Oracle Rdb also allows the "T" character as a separator between date and time portions of a TIMESTAMP literal. This allows literal dates that conform to *ISO 8601 Data elements and interchange formats - Information interchange - Representation of dates and times* which is an International standard for date/time representations.

```
SQL> select timestamp'2013-10-29T14:52:11.42' from rdb$database;

 2013-10-29 14:52:11.42
1 row selected
```

- New SQLCODE values
  The table *Values Returned to the SQLCODE Field* now includes these new SQLCODE values.

Table 3-1 Values Returned to the SQLCODE Field

Numeric Value	Literal Value	Meaning
-1045	SQLCODE_INV_INTERVAL	Invalid interval format
-1046	SQLCODE_INV_FRACSEC	Time, Timestamp or interval has too many fractional digits
-1047	SQLCODE_INV_INTLEAD	Interval leading field is too large
-1048	SQLCODE_INC_CSET	Incompatible character set
-1049	SQLCODE_DATA_CVT_ERROR	Data conversion error

These problems have been corrected in Oracle Rdb Release 7.2.5.4.

3.2.5 Unexpected Bugcheck From Invalid DBKEY Use

Bug 17656896

In prior releases of Oracle Rdb, the test for valid DBKEY (ROWID) values might fail to diagnose some illegal values. The result was a bugcheck when an attempt was made to use these bad DBKEY values.

The following example shows one such case.

```
SQL> begin
cont> set :dbk = _dbkey'-32767:1:0';
cont> end;
SQL>
SQL> select * from employees
cont>  where dbkey = :dbk;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[...]RDSBUGCHK.DMP;
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
virtual address=0000000000000000, PC=FFFFFFFF8191FA30, PS=0000001B
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4. The DBKEY validation has been improved to catch this and similar cases. This is shown in the following example.

```
SQL> select * from employees
cont>  where dbkey = :dbk;
%RDB-E-NO_RECORD, access by dbkey failed because dbkey is no longer associated
with a record
-RDMS-F-NODBK, -32767:1:0 does not point to a data record
SQL>
```

3.2.6 Unexpected ALIGNMENT Faults During Execution of EXPORT DATABASE

Bug 17978363

In prior versions of Oracle Rdb, the SQL EXPORT DATABASE statement might generate excessive ALIGNMENT faults during execution. This occurred during export of the NULL bit vector for each row, so the number of rows exported was directly proportional to the faults produced.

This problem has been corrected in Oracle Rdb Release 7.2.5.4. The cause of these alignment faults has now been corrected.

3.2.7 Data Dictionary Tables Now Use Key Suffix Compression

Bug 18118478

In prior versions of Oracle Rdb, when preparing a database for use by OCI Services for Rdb, indices for the data dictionary tables were created with "Key suffix compression is DISABLED".

The following example shows this setting for the index on the USER$ table.

```
$ @sys$share:RDB_NATCONN73.COM
Operation (prepare/upgrade/drop/add_user/modify_user/remove_user/show_users):
prepare
Database: mf_personnel
Developer version (60/6I/<CR>):
**** Preparing database MF_PERSONNEL ****
**** Preparing database successfully completed ****
Operation (prepare/upgrade/drop/add_user/modify_user/remove_user/show_users):
$
$ sql$
SQL> attach 'file mf_personnel';
SQL> show table USER$
...
Indexes on table USER$:
USER$_NAME                      with column NAME
 No Duplicates allowed
 Type is Sorted
 Key suffix compression is DISABLED
 Node size 430
...
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4. Now such indices will be created with "Key suffix compression is ENABLED". This has the advantage of reducing the size of metadata indices, since most names are space filled to 31 octets.

3.3 RMU Errors Fixed

3.3.1 RMU Parallel Backup Fails with /PROTECTION Qualifier

In releases prior to Oracle Rdb Release 7.2.5.4, there was a problem in RMU/BACKUP/PARALLEL and RMU/BACKUP/PLAN where the information specified in the /PROTECTION qualifier was not correctly reflected in the plan file. As an example, the following RMU command:

```
$ rmu/backup/parallel=executor=1/disk/execute /protection=(S:,O:,G:W,W:R) -
    /list_plan=mfp.plan mf_personnel disk1:[mf_p]mfp.rbf
```

resulted in the following entry in the plan file:

```
    Protection = S:
```

Also, RMU/BACKUP/PLAN/LIST_PLAN failed with the following errors.

```
%CLI-F-SYNTAX, error parsing 'PROTECTION'
-CLI-E-ENTNF, specified entity not found in command tables
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 19-JUN-2013 15:35:05
```

Both problems have been corrected in Oracle Rdb Release 7.2.5.4.

3.3.2 Unexpected Bugcheck During Large RMU Load When Using /Defer_Index_Updates Qualifier

Bug 13402630

In prior releases of Oracle Rdb, it was possible that RMU Load might fail with a bugcheck dump.

```
$ RMU/LOAD -
    ABC_DB -
    LARGE_TABLE -
    LARGE_TABLE_DATA.UNL -
    /Commit=100000 -
    /Defer_Index_Updates -
    /Transaction=exclusive -
    /Buffer=10000
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
```

The workaround was to not use the /Defer_Index_Updates qualifier.

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.3.3 RMU/BACKUP/AFTER_JOURNAL Returned a Success Status if %RMU-F-AIJJRNBSY

Bug 17316940

When the Oracle Rdb RMU/BACKUP/AFTER_JOURNAL command is backing up Rdb database After Image Journal files and the backup cannnot continue because RMU cannot access an AIJ file, it outputs the fatal error:

```
%RMU−F−AIJJRNBSY, journal AIJ_FILE_NAME is busy and cannot be backed up
```

The backup is then terminated. However, even though the RMU/BACKUP/AFTER_JOURNAL command was terminated because of a fatal error and did not complete, the backup operation returned a success exit status and the following output success message so that the %RMU−F−AIJJRNBSY failure status could be overlooked.

```
%RMU−I−AIJBCKEND, after−image journal backup operation completed successfully
```

This problem has been fixed. Now, when the fatal %RMU−F−AIJJRNBSY error condition occurs, the misleading message will no longer be output and the %RMU−F−AIJJRNBSY fatal error status will be set as the RMU/BACKUP/AFTER_JOURNAL command exit status instead of the incorrect success status.

The following example shows the problem. The after image journal file backup operation is terminated and the %RMU−F−AIJJRNBSY fatal error is output but the backup operation returns a success status and the following misleading message is output:

```
%RMU−I−AIJBCKEND, after−image journal backup operation completed successfully
```

Here is the example.

```
$ rmu/back/after_after/log mf_personnel mfpaijbck
%RMU−I−AIJBCKBEG, beginning after−image journal backup operation
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation started
%RMU−I−AIJBCKSEQ, backing up after−image journal sequence number 0
%RMU−I−LOGBCKAIJ, backing up after−image journal AIJ1 at 10:04:53.86
%RMU−I−QUIETPT, waiting for database quiet point at 21−OCT−2013 10:04:53.86
%RMU−I−QUIETPTREL, released database quiet point at 21−OCT−2013 10:04:53.91
%RMU−F−AIJJRNBSY, journal AIJ1 is busy and cannot be backed up
%RMU−I−AIJNOBACKUP, AIJ contains no transactions that qualify for backup
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation completed
%RMU−I−AIJBCKEND, after−image journal backup operation completed successfully
MALIBU>SHOW SYMBOL $STATUS
  $STATUS == "%X10000001"
```

The following example shows that this problem has been fixed. The fatal %RMU−F−AIJJRNBSY error is now the return status of the after image journal file backup operation and the misleading message is not output.

```
$ rmu/back/after/log mf_personnel mfpaijbck
%RMU−I−AIJBCKBEG, beginning after−image journal backup operation
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation started
%RMU−I−AIJBCKSEQ, backing up after−image journal sequence number 0
%RMU−I−LOGBCKAIJ, backing up after−image journal AIJ1 at 10:04:53.86
%RMU−I−QUIETPT, waiting for database quiet point at 21−OCT−2013 10:04:53.86
%RMU−I−QUIETPTREL, released database quiet point at 21−OCT−2013 10:04:53.91
%RMU−F−AIJJRNBSY, journal AIJ1 is busy and cannot be backed up
%RMU−I−AIJNOBACKUP, AIJ contains no transactions that qualify for backup
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation completed
MALIBU>SHOW SYMBOL $STATUS
```

```
  $STATUS == "%X12C8ADAC"
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.3.4 Unexpected Failure of RMU/SET AIP and RMU/SHOW AIP

Bug 17722306

In prior releases of Oracle Rdb, the RENAME TABLE and RENAME INDEX commands modified the logical area names for the referenced object, including padding spaces. This did not affect the functioning of the tables or indices but caused some confusion when using tools such as RMU/SET AIP or RMU/SHOW AIP. For these commands, the trailing spaces are significant and they would fail to find the named objects.

The following example shows the renaming of a table. Using SET FLAGS 'STOMAP_STATS' you can clearly see the log messages using space padded names.

```
SQL> set flags 'stomap_stats';
SQL>
SQL> rename table EXAMPLE_TABLE_NAME
cont>     to NEW_EXAMPLE_TABLE_NAME;
~As: reads: async 0 synch 53, writes: async 20 synch 0
SQL>
SQL> commit;
%RDMS-I-LOGMODSTR,     modified logical area name to "NEW_EXAMPLE_TABLE_NAME
      "
%RDMS-I-LOGMODSTR,     modified logical area name to "NEW_EXAMPLE_TABLE_NAME
      "
%RDMS-I-LOGMODSTR,     modified logical area name to "NEW_EXAMPLE_TABLE_NAME
      "
%RDMS-I-LOGMODSTR,     modified logical area name to "NEW_EXAMPLE_TABLE_NAME
      "
SQL>
```

A subsequent attempt to update the logical areas (using RMU/SET AIP) fails to locate the new name, as is true for RMU/SHOW AIP.

```
$ rmu/set aip abc NEW_EXAMPLE_TABLE_NAME/length/log
%RMU-F-NOLAREAFOUND, No logical areas match the specified selection parameters
%RMU-F-FTL_RMU, Fatal error for RMU operation at  5-NOV-2013 14:35:39.05
$
$ rmu/show aip abc NEW_EXAMPLE_TABLE_NAME
*-------------------------------------------------------------------------------
* Logical Area Name             LArea PArea   Len Type
*-------------------------------------------------------------------------------
$
```

However, using a wildcard the names are located.

```
$ rmu/show aip abc NEW_EXAMPLE_TABLE_NAME*/brief
*-------------------------------------------------------------------------------
* Logical Area Name             LArea PArea   Len Type
*-------------------------------------------------------------------------------
NEW_EXAMPLE_TABLE_NAME             61     3   665 TABLE
NEW_EXAMPLE_TABLE_NAME             62     4   665 TABLE
NEW_EXAMPLE_TABLE_NAME             63     5   665 TABLE
```

```
NEW_EXAMPLE_TABLE_NAME              64     2   665 TABLE
$
```

The problem with RMU/SET AIP and RMU/SHOW AIP can be avoided by using wildcard specifications of the object name, using "*" wildcard to match the trailing spaces, or using delimited names on the DCL command line that include the trailing spaces.

The database administrator can modify the names of the logical areas using RMU/SET AIP/RENAME. However, Oracle suggests great care be taken to not change the name (apart from removing trailing spaces) as this will cause issues with future DDL operations.

```
$ rmu/set aip abc NEW_EXAMPLE_TABLE_NAME*/rename=NEW_EXAMPLE_TABLE_NAME/log
%RMU-I-AIPSELMOD, Logical area id 61, name NEW_EXAMPLE_TABLE_NAME
selected for modification
%RMU-I-AIPSELMOD, Logical area id 62, name NEW_EXAMPLE_TABLE_NAME
selected for modification
%RMU-I-AIPSELMOD, Logical area id 63, name NEW_EXAMPLE_TABLE_NAME
selected for modification
%RMU-I-AIPSELMOD, Logical area id 64, name NEW_EXAMPLE_TABLE_NAME
selected for modification
$
$ rmu/show aip abc NEW_EXAMPLE_TABLE_NAME/brief
*-------------------------------------------------------------------------------
* Logical Area Name             LArea PArea   Len Type
*-------------------------------------------------------------------------------
NEW_EXAMPLE_TABLE_NAME              61     3   665 TABLE
NEW_EXAMPLE_TABLE_NAME              62     4   665 TABLE
NEW_EXAMPLE_TABLE_NAME              63     5   665 TABLE
NEW_EXAMPLE_TABLE_NAME              64     2   665 TABLE
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4. Oracle Rdb has been corrected to pass the object name without the padding spaces.

3.3.5 RMU/SET AUDIT Ignoring "*" Wildcard for the IDENTIFIERS Option

In prior releases of Oracle Rdb, the RMU Set Audit command ignored the "*" when specified for /ENABLE=IDENTIFIERS=* or /DISABLE=IDENTIFIERS=* to select all users to be audited.

The following example shows that a successful RMU command didn't change the enabled identifiers.

```
$ rmu/show audit/ident TEST_DB

Enabled identifiers:
    None

$ rmu/set audit/enable=ident=* TEST_DB
$ rmu/show audit/ident TEST_DB

Enabled identifiers:
    None

$
```

A workaround to this problem is to specify the string "[*]" which is an equivalent specification.

This problem has been corrected in Oracle Rdb Release 7.2.5.4. RMU now correctly interprets the * as a request to audit all user and role (rights) identifiers used by the database.

```
$ rmu/show audit/ident TEST_DB

Enabled identifiers:
    None

$ rmu/set audit/enable=ident=* TEST_DB
$ rmu/show audit/ident TEST_DB

Enabled identifiers:
    (IDENTIFIER=*)

$
```

3.4 RMU Show Statistics Errors Fixed

3.4.1 RMU/SHOW STATISTICS Could Display Incorrect Statistics For New Logical Areas

Bug 17012472

RMU/SHOW STATISTICS could display incorrect statistics for new logical areas created in an Oracle Rdb database after the database had been opened by the Rdb database monitor. In addition, a system access violation could occur. This happened because the maximum size of the structure created by the monitor to hold logical area statistics when the database was opened, which was based on the then current maximum logical area identifier number in the database root, was not checked by the RMU/SHOW STATSTICS command when displaying logical area statistics for tables or indexes.

Because of this problem, when RMU/SHOW STATISTICS was looping through the structure used to hold logical area statistics, it could exceed the space allocated for table and index logical areas. The newly created logical area names would be displayed but the statistics for these logical areas would be incorrect and an access violation could eventually occur if a large enough number of new logical areas had been created since the last time the database was opened.

The only way to avoid this problem is to close and reopen the database so the sructure holding the logical area statistics can be correctly allocated by the Rdb monitor to include the newly created logical areas. Note that if logical areas that existed when the database was opened are deleted, Oracle Rdb will reuse these newly available logical area entries in the logical area statistics structure. This problem will only happen if no existing entries can be reused and a new logical area identifier number must be assigned to the new logical area which will cause the allocated size of the logical area statistics structure to be exceeded.

This problem only happened when RMU/SHOW STATISTICS was displaying logical area statistics. Oracle Rdb correctly did not collect or modify statistics for newly created logical areas with a logical area identifier number that would exceed the size of the currently allocated logical area statistics structure allocated by the Rdb monitor when the database was opened.

This problem has been fixed. Now RMU/SHOW STATISTICS will not display the statistics for table and index logical areas created since the database was opened if these logical area statistics are not being collected because space for these logical areas could not be allocated in the current logical area statistics structure. Only closing and reopening the database will cause these statistics to be allocated, collected and displayed. New logical areas can be created and accessed in the database, but if the statistics for these logical areas would exceed the current allocated size of the logical area statistics structure, statistics will not be displayed for these logical areas until the next time the database is closed and then reopened.

The following example shows the problem (some columns on the statistics screen have been omitted due to space considerations). The NEW_TABLE logical area NEW_LOGICAL_AREA, created since the database was last opened, is being displayed with incorrect logical area statistics even though statistics are not being collected for this logical area since space for the statistics could not be allocated in the logical area statistics structure allocated when the Rdb monitor opened the database. In this case, the "record_fetch" and "record_store" numbers being displayed are incorrect and do not change when records are inserted into or selected from NEW_TABLE.

```
$ RMU/SHOW STATISTICS MF_PERSONNEL.RDB

Node: NODE12 (1/1/16)          Oracle Rdb V7.2−530 Perf. Monitor
Rate: 3.00 Seconds              Logical Area Overview (Tables)
Page: 1 of 1                   DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−
Logical.Area.Name.................record fetch record store record erase
CANDIDATES.RDB$SYSTEM                          0            0            0
COLLEGES.EMP_INFO                              0            0            0
DEGREES.EMP_INFO                               0            0            0
DEPARTMENTS.DEPARTMENTS                        0            0            0
EMPLOYEES.EMPIDS_LOW                           0            0            0
EMPLOYEES.EMPIDS_MID                         100            0            0
EMPLOYEES.EMPIDS_OVER                          0            2            0
JOBS.JOBS                                      5            0            0
JOB_HISTORY.EMPIDS_LOW                         0            0            0
JOB_HISTORY.EMPIDS_MID                         0            0            0
JOB_HISTORY.EMPIDS_OVER                        0            0            0
RESUMES.EMP_INFO                               0            0            0
SALARY_HISTORY.SALARY_HISTORY                  0            0            0
WORK_STATUS.EMP_INFO                           0            0            0
NEW_TABLE.NEW_LOGICAL_AREA          925698763217  73528196392            0
```

The following example shows a system access violation that can result from this problem on a VMS system with RAD support enabled, where logical area statistics are stored in RAD global sections. Though access violations can occur due to this problem in other configurations, here RAD support is not enabled.

```
$ RMU/SHOW STATISTICS RAD_DATABASE
%SYSTEM−F−ACCVIO, access violation, reason mask=00,
virtual address=0000000007F54000, PC=FFFFFFFF809F0371, PS=0000001B

$ TYPE RMUBUGCHK.DMP

This file was generated by Oracle Rdb V7.2−520 upon detection of a
fatal, unexpected, error.  Please return this file, the query or program that
produced the bugcheck, the database, monitor log, and any other pertinent
information to your Oracle support representative for assistance.

================================================================================
        Stack Dump Summary
================================================================================

***** Exception at 00000000809F0371 : RMU72\KUTDIS$COLLECT_STATS + 00001161
%SYSTEM−F−ACCVIO, access violation, reason mask=00,
virtual address=0000000007F54000, PC=FFFFFFFF809F0371, PS=0000001B
Saved PC = 00000000809E63A0 : RMU72\KUTDIS$DISPLAY_ASTX + 000000F0
Saved PC = 00000000809E7830 : RMU72\KUTDIS$DISPLAY_STALL_ASTX + 00000210
Saved PC = 00000000808588F0 : RMU72\KUT$DISPLAY + 00003BC0
Saved PC = 000000008040D730 : RMU72\RMU$DISPLAY + 000045F0
Saved PC = 0000000080014D00 : RMU72\RMU$SHOW + 000014D0
Saved PC = 00000000803343F0 : RMU72\RMU_DISPATCH + 00002950
Saved PC = 00000000803312F0 : RMU72\RMU_STARTUP + 00000920
Saved PC = 0000000080000C20 : RMU72\ELF$TFRADR + 00000050
Saved PC = FFFFFFFF824D4E80 : Image PTHREAD$RTL + 0004AE80
Saved PC = FFFFFFFF8248A6C0 : Image PTHREAD$RTL + 000006C0
Saved PC = 000000007AE25080 : Image DCL + 0006D080
```

The following example shows that this problem has been fixed (some columns on the statistics screen have been omitted due to space considerations). Now, logical area statistics are not being displayed for the NEW_TABLE NEW_LOGICAL_AREA logical area since space for them could not be allocated in the

logical area statistics structure allocated when the Rdb monitor opened the database. The next time the database is closed and reopened, the logical area statistics for the NEW_TABLE NEW_LOGICAL_AREA logical area will be collected and displayed since the monitor has now allocated space for the NEW_TABLE NEW_LOGICAL_AREA logical area in the logical area statistics structure.

```
$ RMU/SHOW STATISTICS MF_PERSONNEL.RDB

Node: NODE12 (1/1/16)          Oracle Rdb V7.2−530 Perf. Monitor
Rate: 3.00 Seconds              Logical Area Overview (Tables)
Page: 1 of 1                   DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−
Logical.Area.Name.................record fetch record store record erase
CANDIDATES.RDB$SYSTEM                          0            0            0
COLLEGES.EMP_INFO                              0            0            0
DEGREES.EMP_INFO                               0            0            0
DEPARTMENTS.DEPARTMENTS                        0            0            0
EMPLOYEES.EMPIDS_LOW                           0            0            0
EMPLOYEES.EMPIDS_MID                         100            0            0
EMPLOYEES.EMPIDS_OVER                          0            2            0
JOBS.JOBS                                      5            0            0
JOB_HISTORY.EMPIDS_LOW                         0            0            0
JOB_HISTORY.EMPIDS_MID                         0            0            0
JOB_HISTORY.EMPIDS_OVER                        0            0            0
RESUMES.EMP_INFO                               0            0            0
SALARY_HISTORY.SALARY_HISTORY                  0            0            0
WORK_STATUS.EMP_INFO                           0            0            0
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

3.4.2 RMU/SHOW STATISTICS Could Display an Invalid Transaction Elapsed Time

Bug 17295188

RMU/SHOW STATISTICS could sometimes display an absolute time with a date of 17−NOV−1858 instead of a valid elapsed time for process transactions on the Checkpoint Information screen. This problem would correct itself as the current statistics collection time increased or a short transaction terminated.

The problem was that the transaction start time could sometimes be greater than the current statistics collection time when the transaction elapsed time was calculated by RMU/SHOW STATISTICS. This would cause an invalid transaction elapsed time to be displayed as an absolute time with a date of 17−NOV−1858 on the Checkpoint Information screen. This could happen more frequently if cluster wide statistics were being collected, but it could also happen if cluster wide statistics were not being collected.

This problem has been fixed. Now RMU/SHOW STATISTICS will always display a valid elapsed time for process transactions on the Checkpoint Information screen.

The following example shows the problem. An invalid elapsed time of "17−NOV−1858 00:00:01.26" is being displayed by RMU/SHOW STATISTICS for a process transaction on the Checkpoint Information screen.

```
$ RMU/SHOW STATISTICS/CLUSTER MYDB.RDB
Cluster: NODEX (3/3/6)                          Oracle Rdb V7.2−520 Perf.
Monitor                            7−AUG−2013 15:46:10.72
Rate: 5.00 Seconds                              Checkpoint Information
```

```
(Unsorted)                          Elapsed: 20 23:26:45.73
Page: 10 of 27                                DEVICE:DIRECTORY]MYDB.RDB;1
                                        Mode: Online
--------------------------------------------------------------------------------
--------------------------------------------------
Process.ID  Ckpt.Vno:Ckpt.Vbn QuietVno ST CurTSN              TxElapsedTime
AIJ:13260:11346432
2BCF323D:1                    13260
TSN: 582484383
2BCF0E34:1                    13260 RW 582518989
2BDD760C:1                    13260 RW 0
2BD70A9B:1                    13260 RW 582519526     17-NOV-1858 00:00:01.26
2BE8355F:1*                   13260 RW 552876824
2BD9B32D:1                    13260
--------------------------------------------------------------------------------
--------------------------------------------------
Alarm Bell Config Exit Help Menu >next_page <prev_page Refresh Set_rate Write
Zoom !
```

The following example shows that this problem has been fixed. Now, a valid elapsed time of "0 00:00:00.05" is being displayed by RMU/SHOW STATISTICS for a process transaction on the Checkpoint Information screen.

```
$ RMU/SHOW STATISTICS MYDB.RDB
Cluster: NODEX (3/3/6)                        Oracle Rdb V7.2-520 Perf.
Monitor                          12-SEP-2013 12:15:10.27
Rate: 5.00 Seconds                            Checkpoint Information
(Unsorted)                         Elapsed: 20 15:23:42.22
Page: 10 of 27                                  DEVICE:[DIRECTORY]MYDB.RDB;1
                                        Mode: Online
--------------------------------------------------------------------------------
--------------------------------------------------
Process.ID  Ckpt.Vno:Ckpt.Vbn QuietVno ST CurTSN              TxElapsedTime
AIJ:13260:11346432
2BCF323D:1                    13260
TSN: 582484383
2BCF0E34:1                    13260 RW 582518989
2BDD760C:1                    13260 RW 0
2BD70A9B:1                    13260 RW 582519526           0 00:00:00.05
2BE8355F:1*                   13260 RW 552876824
2BD9B32D:1                    13260
--------------------------------------------------------------------------------
--------------------------------------------------
Alarm Bell Config Exit Help Menu >next_page <prev_page Refresh Set_rate Write
Zoom !
```

This problem has been corrected in Oracle Rdb Release 7.2.5.4.

Chapter 4
Software Errors Fixed in Oracle Rdb Release 7.2.5.3

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.3.

4.1 Software Errors Fixed That Apply to All Interfaces

4.1.1 Corrupt SORTED RANKED Index After Row INSERT

Bugs 14261855 and 14099150

In rare cases, an INSERT or UPDATE of a SORTED RANKED index can leave the index incomplete. The reported problem was caused by a cascading node split upon an INSERT. That is, an INSERT caused the node to split and that action caused the parent node to split, and so on up the index. The subsequent verify of the index using RMU/VERIFY/INDEX/DATA reported the missing key values which shows that a sub−tree of the index was not correctly incorporated into the index tree.

The following examples show possible symptoms associated with this problem.

- The originally reported problem showed an unexpected PRIMARY KEY violation.

```
SQL> select * from BILLS_TABLE
cont> where account_id = 200350 and id = 4442;
0 rows selected
SQL> insert into BILLS_TABLE (account_id, id) values (200350, 4442);
%RDB−E−INTEG_FAIL, violation of constraint BILLS_TABLE_PKEY caused operation
to fail
−RDB−F−ON_DB, on database DISK1:[TESTING]SAMPLE_DB.RDB;
SQL> select * from BILLS_TABLE
cont> where account_id = 200350 and id = 4442;
0 rows selected
SQL>
```

  In this case, the corruption (that caused the constraint violation) was rolled back when the constraint failed. RMU/VERIFY/INDEX/DATA at this point shows that the index remains unaffected.
- After dropping the primary key constraint and repeating the INSERT, an RMU/VERIFY/INDEX/DATA was performed on the database and now shows the problem.

```
$ RMU/VERIFY/INDEX/DATA SAMPLE_DB.RDB
%RMU−I−BADENDLVL, Last b−tree level at level 2 had non−null next pointer.
                  Last b−tree node points to logical dbkey 711:34136:6.
%RMU−I−BADENDLVL, Last b−tree level at level 3 had non−null next pointer.
                  Last b−tree node points to logical dbkey 711:34182:8.
%RMU−I−BTRROODBK, root dbkey of B−tree is 711:3900:2
%RMU−W−DATNOTIDX, Row in table BILLS_TABLE is not in any indexes.
                  Logical dbkey is 1976:3694:68.
%RMU−W−DATNOTIDX, Row in table BILLS_TABLE is not in any indexes.
                  Logical dbkey is 1976:3694:69.
...DATNOTIDX repeated for other missing index references
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. Oracle recommends that each SORTED RANKED index be verified using RMU/VERIFY/INDEX/DATA. Any reported problems should be repaired by using DROP INDEX, followed by a CREATE INDEX, or use an ALTER INDEX ... TRUNCATE ALL PARTITIONS, followed by an ALTER INDEX ... BUILD ALL PARTITIONS. If these indices are in UNIFORM format storage areas, a COMMIT and DISCONNECT ALL between each step will optimize page

re−use and reduce the need to extend the storage areas used by the indices.

4.1.2 Node Failure May Cause DBRs to Hang

Bug 14582053

Under normal conditions, if Oracle Rdb is running in a cluster environment and one of the members fails, database recovery processes (DBR) will automatically be created on one of the other cluster members where the database is currently open to recover the database users running on that failed node.

In rare circumstances, it was possible for one or more of those DBR's to become blocked waiting for a database page lock held by an active user. That user would be blocked waiting for cluster membership (PR). This scenario would be more likely to occur when the systems were under a heavy load, such that the recovering node is resource constrained and creating recovery processes in such an environment takes longer than usual.

The workaround would be to DELPRC or STOP/ID all those blocker processes, or stop all database activity on the remaining nodes using RMU/CLOSE/CLUSTER /ABORT=DELPRC <database−name>, then reopen the database. The next attach would cause DBRs to be created and recovery should complete successfully.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The blocker transaction will now release the contested resource, allowing the recovery to continue.

4.1.3 Session Crash if Run Time Routine Native Compiler Enabled

Bugs 13495444 and 15979892

In some instances when using the "Just−in−Time native compiler for Itanium systems" (SET FLAGS 'CODE_OPTIMIZATION(2)', which is the default), where a large (greater than 8K) code routine is generated, a stack corruption could occur resulting in the current process being deleted. A large arithmetic expression involving float values is one way to possibly cause the problem.

Turning off the compiler by using SET FLAGS 'CODE_OPTIMIZATION(0)' is a viable workaround.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.1.4 ACCVIO In COSI_MEM_GET_VM64_2

Bug 16510902

When using the "Just−in−Time native compiler for Itanium systems" (SET FLAGS 'CODE_OPTIMIZATION(2)') which is the default, if an extremely large code routine was generated, an ACCVIO and bugcheck dump could occur due to incorrectly allocated memory.

Turning off the compiler by using SET FLAGS 'CODE_OPTIMIZATION(0)' is a viable workaround.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.1.5 Unexpected Loop During Query Optimization

Bug 15989490

Starting with release 7.2.5.1 of Oracle Rdb, it was possible for the Rdb optimizer to enter an unending loop while compiling some queries. This occurred when the logical name RDMS$USE_OLD_UPDATE_RULES was defined as 1. This logical name is mostly used when RDO, RDBPRE or RDML applications require MODIFY or ERASE clauses on joined tables.

The only workaround is to deassign the logical RDMS$USE_OLD_UPDATE_RULES.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The Rdb optimizer has been corrected to correctly handle some complex queries which would cause it to loop.

4.1.6 Unexpected Bugcheck During Query Execution at RDMS$$SET_USED_OR_DESCENDANTS

Bug 16220090

In some cases, a query might bugcheck when processing a subselect within a DISTINCT aggregation. The following query shows the unexpected bugcheck.

```
SQL> set dialect 'oracle level1';
cont> select distinct test.col2,
cont> (select col1 from test alg
cont>  where test.col1=alg.col1),
cont> '' as flags_comment
cont> from test
cont> order by test.col2 limit to 1 rows;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file <directory>RDSBUGCHK.DMP;
```

In the above query, the quoted string (named FLAGS_COMMENT) has zero length and is treated as NULL in ORACLE dialects and is the cause of the bugcheck. In other dialects, selecting NULL explicitly will also result in a bugcheck. Both DISTINCT and LIMIT TO (aka FETCH FIRST) must be present to reproduce the problem.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.1.7 Wrong Result When Constant Boolean Appears in Predicate

Bugs 16459683 and 16452838

In prior releases of Oracle Rdb, it was possible that queries using a predicate containing only literal values would produce the wrong results. Consider this simple example.

```
SQL> create index ip on employees ( postal_code, sex ) ;
SQL>
SQL> set flags 'strategy,detail(2),execution';
SQL>
```

```
SQL> select first_name, last_name, postal_code
cont> from employees
cont> where sex in ('M','F' )
cont>       and postal_code in ( '03455','03456' )
cont>       and (1 = 1);
~S#0001
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: ((0.SEX = 'M') OR (0.SEX = 'F')) AND ((0.POSTAL_CODE = '03455') OR (
        0.POSTAL_CODE = '03456'))
  BgrNdx1 IP [(1:1)2] Fan=15
    Keys: r0: 0.POSTAL_CODE = '03456'
          r1: 0.POSTAL_CODE = '03455'
    Bool: ((0.SEX = 'M') OR (0.SEX = 'F')) AND (1 = 1)
~E Leaf−level Constant Boolean was FALSE
0 rows selected
SQL>
```

Notice that the execution trace "~E Leaf−level Constant Boolean was FALSE" is erroneously generated and thus the query prematurely terminates the dynamic background process (BgrNdx1).

This problem can also be observed when the DIALECT is set to ORACLE LEVEL1 or ORACLE LEVEL2 and the ROWNUM expression is used. Consider the following example:

```
SQL> set dialect 'ORACLE LEVEL2';
SQL>
SQL> create index ip on employees ( postal_code, sex ) ;
SQL>
SQL> set flags 'strategy,detail(2),execution';
SQL>
SQL> select first_name, last_name, postal_code
cont> from employees
cont> where sex in ('M','F' )
cont>       and postal_code in ( '03455','03456' )
cont>       and rownum < 3;
~S#0001
Tables:
  0 = EMPLOYEES
Firstn: 3 − 1
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: ((0.SEX = 'M') OR (0.SEX = 'F')) AND ((0.POSTAL_CODE = '03455') OR (
        0.POSTAL_CODE = '03456'))
  BgrNdx1 IP [(1:1)2] Fan=15
    Keys: r0: 0.POSTAL_CODE = '03456'
          r1: 0.POSTAL_CODE = '03455'
    Bool: ((0.SEX = 'M') OR (0.SEX = 'F')) AND (1 < 3)
~E Leaf−level Constant Boolean was FALSE
0 rows selected
SQL>
```

This usage of ROWNUM is rewritten by Rdb to use a FETCH FIRST clause and the original reference to ROWNUM is converted to the literal 1 as this retains the NULL semantics of the original query. This revised query produces the same characteristics as described above.

These problems have been corrected in Oracle Rdb Release 7.2.5.3.

4.1.8 Query With Zig−zag Match Strategy Returns Wrong Result

Bugs 16609867 and 16848756

In some cases, the Oracle Rdb optimizer might not process a zig−zag match strategy correctly. This error was introduced by a correction to a similar problem in Oracle Rdb Release 7.2.5.1.

The problem may occur under these conditions:

- When a predicate contains an equality with a literal value and the right−hand side references a function. For example: 'N' = FUNC(). Even though this equality may not be used as a filter in the zig−zag match, Rdb may incorrectly pick up the right−hand side "function" as a limiting value for the zig−zag search.
  Rotating the operands can work around this problem, such as FUNC() = 'N', where the limiting value now correctly becomes 'N'. This is the case in the problem reported in Bug 16609867. Instead of a function at the right−hand side, it may be a view or a mapped variable.
- When the WHERE clause contains more than one filter equality with the right−hand side referencing view columns, as in the following example: 1 = view_column_1 AND 2 = view_column_2. The Rdb optimizer should not care about the ordering of the operands but may erroneously select the "view_column" as the limiting value for the zig−zag search.
  Rotating the operands can work around this problem, such as view_column_1 = 1 AND view_column_2 = 2 where the limiting value now becomes '1' and '2'. This is the case in the problem reported in Bug 16848756. Instead of view column at the right−hand side, it may be the column itself that causes the problem, for example: 1 = column_1 AND 2 = column_2.

The workaround is to disable the zigzag match by defining the following logical:

```
$DEFINE RDMS$DISABLE_ZIGZAG_MATCH 2
```

These problems have been corrected in Oracle Rdb Release 7.2.5.3.

4.1.9 Unexpected Bugcheck When Altering a LIST Storage Map

Bug 16879262

In prior releases of Oracle Rdb, a DROP TABLE or ALTER TABLE ... DROP COLUMN statement that caused an implicit update to the LIST storage map might lead to a subsequent bugcheck dump during an ALTER STORAGE MAP statement. The cached version of the LIST storage map is not kept in synchronization with the one on disk.

The following example shows the problem.

```
SQL> drop table TEMP_DOC_1;
SQL> create table TEMP_DOC_2 (col3 list of byte varying);
SQL> alter storage map LISTS_MAP
cont>     store LISTS
cont>         in DOCS for (TEMP_DOC_2);
%RDMS−I−BUGCHKDMP, generating bugcheck dump file DISK1:[TESTING]RDSBUGCHK.DMP;
```

```
%RDMS-I-BUGCHKDMP, generating bugcheck dump file DISK1:[TESTING]RDSBUGCHK.DMP;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-E-BAD_CODE, corruption in the query string
SQL>
```

A workaround is to issue a DISCONNECT ALL and re-attach to the database prior to using the ALTER STORAGE MAP statement on the LIST map.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The LIST storage map is now correctly reloaded after a DROP TABLE or ALTER TABLE ... DROP COLUMN statement if they change the LIST map.

4.1.10 Oracle Rdb Monitor Log File Shows Inconsistent PIDs When Accessing a Database From JAVA

Bug 16708710

In prior releases of Oracle Rdb, if you access an Oracle Rdb database from a JAVA application, the Rdb Monitor Log File will contain inconsistent process IDs (PID) between the "User Attach Request" and "User Termination" entries, as in the following example:

```
23-APR-2013 09:46:41.17 - Received user attach request from 220008E0:2
  - process name RDBTHINBUG, user USER1
  - image name "$1$DGA4:[SYS2.SYSCOMMON.][JAVA$60.BIN]JAVA$JAVA.EXE;1"
  - database name "$1$DGA13:[USER1.TEST72]MF_PERSONNEL.RDB;1" [_$1$DGA13]
(130,3,0)
  - opening as monitor ID 1
  - sending normal user attach reply to 220008E0:2

23-APR-2013 09:46:41.24 - Received user image termination from 220004E0:2
  - database name "$1$DGA13:[USER1.TEST72]MF_PERSONNEL.RDB;1" [_$1$DGA13]
(130,3,0)
  - database shutdown is complete
```

These PIDs are valid PIDs. Multiple PIDs for the same JAVA application indicate that JAVA has created multiple kernel threads for it's execution. The error was solely in the formatting of the message being logged and has now been fixed. The PIDs displayed for each JAVA thread will be that of the initial PID and the STREAM ID will distinguish one thread from another, as in the following example:

```
29-MAY-2013 07:44:34.86 - Received user attach request from 00186912:1
  - process name RDBTHINBUG, user USER1
  - image name "$1$DGA1:[SYS0.SYSCOMMON.][JAVA$150.BIN]JAVA$JAVA.EXE;1"
  - database name "$1$DGA4:[USER1.WORK.W3]MF_PERSONNEL.RDB;1" [_$1$DGA4]
(1278,373,0)
  - opening as monitor ID 1
  - sending normal user attach reply to 00186912:1

29-MAY-2013 07:44:37.82 - Received user attach request from 00186912:2
  - process name RDBTHINBUG, user USER1
  - image name "$1$DGA1:[SYS0.SYSCOMMON.][JAVA$150.BIN]JAVA$JAVA.EXE;1"
  - database name "$1$DGA4:[USER1.WORK.W3]MF_PERSONNEL.RDB;1" [_$1$DGA4]
(1278,373,0)
  - opening as monitor ID 1
  - sending normal user attach reply to 00186912:2

 29-MAY-2013 07:44:37.94 - Received user image termination from 00186912:2
```

```
  − database name "$1$DGA4:[USER1.WORK.W3]MF_PERSONNEL.RDB;1" [_$1$DGA4]
(1278,373,0)
  − database shutdown is complete

29−MAY−2013 07:44:40.00 − Received user attach request from 00186912:3
  − process name RDBTHINBUG, user USER1
  − image name "$1$DGA1:[SYS0.SYSCOMMON.][JAVA$150.BIN]JAVA$JAVA.EXE;1"
  − database name "$1$DGA4:[USER1.WORK.W3]MF_PERSONNEL.RDB;1" [_$1$DGA4]
(1278,373,0)
  − opening as monitor ID 1
  − sending normal user attach reply to 00186912:3

29−MAY−2013 07:44:40.11 − Received user image termination from 00186912:3
  − database name "$1$DGA4:[USER1.WORK.W3]MF_PERSONNEL.RDB;1" [_$1$DGA4]
(1278,373,0)
  − database shutdown is complete
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.1.11 New Error Message − ABMCHNFUL

Bug 14027468

Within a uniform storage area, area bit map (ABM) pages are used to optimize the search for space management (SPAM) pages. The ABM pages are chained together. If the ABM chain becomes full, no more SPAM pages can be added to the storage area. In previous releases of Rdb, such a circumstance would generate a STAREAFUL error:

```
%RDMS−F−STAREAFUL, storage area MYDISK:[MFP]MF_PERS_SEGSTR.RDA is full
```

Starting with this release, a new message will be displayed to distinguish the error from other types of STAREAFUL messages:

```
%RDMS−F−ABMCHNFUL, max ABM chain reached for MYDISK:[MFP]MF_PERS_SEGSTR.RDA
```

To continue after such an error, you will need to backup your database and restore the backup, specifying a larger page size for the affected storage area. This will cause the ABM chain to be rebuilt, allowing for the creation of additional SPAM pages.

For example, if your storage area page size is 2 blocks per page, then the maximum SPAM pages for that area would be 23328. After backing up and restoring with a page size of 4, the maximum SPAM pages grows to 47904.

You can use the RMU/DUMP/HEADER to display these values:

```
Storage area "MF_PERS_SEGSTR"
    Area ID number is 8
    Filename is "DISK:[USER.BUGS.14027468]MF_PERS_SEGSTR.RDA;1"
    Access mode is READ/WRITE
    Pages...
      − Page format is uniform
      − Page size is 2 blocks
      − Initial data page count was 402
      − Current physical page count is 403
      − Page checksums are enabled
      − Row level locking is enabled
```

```
        . . . .
    Space Management...
      - SPAMS are enabled
      - Interval is 1089 data pages
      - Current SPAM page count is 1
      - Clump page count is 3
      - Maximum usable SPAM page count is 23328

Storage area "MF_PERS_SEGSTR"
    Area ID number is 8
    Filename is "DISK:[USER.BUGS.14027468]MF_PERS_SEGSTR.RDA;1"
    Access mode is READ/WRITE
    Pages...
      - Page format is uniform
      - Page size is 4 blocks
      - Initial data page count was 402
      - Current physical page count is 403
      - Page checksums are enabled
      - Row level locking is enabled
        . . . .
    Space Management...
      - SPAMS are enabled
      - Interval is 1089 data pages
      - Current SPAM page count is 1
      - Clump page count is 3
      - Maximum usable SPAM page count is 47904
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2 SQL Errors Fixed

4.2.1 Unexpected Support of NOT NULL Syntax for COMPUTED BY Columns

In prior releases of Oracle Rdb, NOT NULL constraints were permitted for COMPUTED BY columns. Such constraints can never be used because COMPUTED BY columns are not updated during INSERT or UPDATE statements.

This release of Rdb will report an informational message and ignore such constraints. Any scripts or applications that include such definitions in a CREATE TABLE or an ALTER TABLE statement may be modified to remove the NOT NULL definitions.

The following example shows the new behavior. The definition is accepted (for backward compatibility) but the definition is ignored.

```
SQL> create table SAMPLE (a integer, b computed by a+1 not null not deferrable);
%SQL-I-NOTNULLNOTCB, Computed column B may not have a NOT NULL constraint -
SAMPLE_B_NOT_NULL ignored
SQL> show table (column) SAMPLE;
Information for table SAMPLE

Columns for table SAMPLE:
Column Name                    Data Type        Domain
-----------                    ---------        ------
A                              INTEGER
B                              BIGINT
 Computed:       by a+1

SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2.2 Unexpected Behavior of SET DISPLAY CHARACTER SET Statement

Bug 14640028

In prior releases of Oracle Rdb, the SET DISPLAY CHARACTER SET statement did not correctly establish the character set in the server if it followed a SET AUTOMATIC TRANSLATION ON statement.

The following example shows new correct behavior. Using the SET FLAGS command, we can see that SET DISPLAY CHARACTER SET statement now implicitly defines the new character set to be used by AUTOMATIC TRANSLATION.

```
SQL> set flags 'item_list';
SQL> set automatic translation on;
~H Extension (SQL LEVEL SETUP) Item List: (len=8)
0000 (00000) RDB$K_EXT_LVL_AUTOTRANS "32767"
0007 (00007) RDB$K_INFO_END
```

```
SQL> set display character set 'dec_mcs';
~H Extension (SQL LEVEL SETUP) Item List: (len=8)
0000 (00000) RDB$K_EXT_LVL_AUTOTRANS "0"
0007 (00007) RDB$K_INFO_END
SQL>
```

A workaround is to execute the SET DISPLAY CHARACTER SET statement prior to executing the SET AUTOMATIC TRANSLATION ON statement.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2.3 Unexpected Stall When Calling External Routines

Bug 13550848

In prior releases of Oracle Rdb, the use of variable constraints, or a STEP clause of the FOR counted loop could interfere with the correct execution of external functions and procedures. The STEP clause implicitly declares a local variable with a constraint to ensure that the STEP value is neither NULL nor zero, as those values would create an infinite loop.

The following example shows the simplest case of this problem.

```
SQL> create procedure LIB$PUT_OUTPUT
cont>     (in :a long varchar by descriptor);
cont> external
cont>     name LIB$PUT_OUTPUT
cont>     location 'SYS$SHARE:LIBRTL.EXE'
cont>     language GENERAL
cont>     GENERAL parameter style
cont> ;
SQL>
SQL> begin
cont> declare :s constant integer = 1
cont>     check (value is not NULL);
cont> call LIB$PUT_OUTPUT (:s);
cont> end;
...stalled...
```

This is an example using a FOR counted loop and a STEP clause. If the STEP clause is removed, the compound statement and its call to the MOD function executes normally.

```
SQL> set flags 'trace'
SQL> begin
cont> declare :i integer;
cont> for :i in 1 to 10 step 1
cont> do
cont>     trace mod(:i, 10);
cont> end for;
cont> end;
...stalled...
```

RMU/SHOW STATISTICS will report that the process is "waiting for routine" in the Stall Messages display.

```
Process.ID  Since..... T Stall.reason.............................Lock.ID.
20601B3D:1  04:21:53.55 W waiting for routine MOD
```

In some cases, the process might report an ACCVIO similar to the following.

```
%SYSTEM-F-ACCVIO, access violation, reason mask=04, virtual
address=000000003FFFFF20, PC=0000000000B9B034, PS=0000001B
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2.4 Unexpected Query Error COSI-F-INVCLADTY

Bug 15853351

In prior versions of Oracle Rdb, queries might fail with the error COSI-F-INVCLADTY when the table storage map is defined as PARTITIONING IS NOT UPDATABLE and a sequential access strategy is chosen for the query. This error occurs when date/time literal values are used to determine the smallest subset of partitions required for the query. The column being compared to the literal need not be a member of the partitioning columns.

The following example shows a comparison between a DATE literal value and a TIMESTAMP(2) column.

```
SQL> set flags 'strategy,detail(2)';
SQL> select * from test where order_date > date'2012-10-20';
Tables:
  0 = TEST
Conjunct: 0.ORDER_DATE > DATE '2012-10-20'
Get     Retrieval sequentially of relation 0:TEST       (partitioned scan#1)
%RDB-E-CONVERT_ERROR, invalid or unsupported data conversion
-COSI-F-INVCLADTY, invalid class data type combination in descriptor
SQL>
```

To avoid this problem, the literal can be changed to match the data type of the column, namely, TIMESTAMP'2012-10-20 00:00:00.00'.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. Oracle Rdb no longer attempts to convert between different date/time types using OpenVMS conversion routines. Such types are internal to Oracle Rdb and should not have been processed in this way.

4.2.5 Unexpected BAD_REQ_HANDLE Reported During Query Compile

Bug 14689425

In prior releases of Oracle Rdb, it was possible that views that referenced SQL functions would fail to execute. The failure is reported as BAD_REQ_HANDLE in this example.

```
SQL> select * from PROBLEM_VIEW;
%RDB-E-RTN_FAIL, routine "(unknown)" failed to compile or execute successfully
-RDB-E-BAD_REQ_HANDLE, invalid request handle
SQL>
```

This problem occurs because an attempt is made to evaluate a function during query strategy generation. Such functions will be defined as (or default to) NOT DETERMINISTIC and be passed no parameters, or only constant literal parameters.

One workaround is to use the ALTER FUNCTION ... COMPILE option to ensure those functions are compiled before the query is executed and ready to execute by querying the view.

```
SQL> alter function PARAM_VALUE compile;
SQL> alter function COMP_NEXT_DAY compile;
SQL> select * from PROBLEM_VIEW;
0 rows selected
SQL>
```

An alternate workaround is to modify the function to be NOT DETERMINISTIC. This will exclude it from pre−evaluation in the optimizer.

```
SQL> alter function COMP_NEXT_DAY not deterministic;
```

The side effect of this change is possibly less optimal query solutions for some queries.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The Rdb query compiler now ensures that views are processed to compile referenced functions before the Rdb optimizer uses them.

4.2.6 Multiple Alias References Not Detected for Sequences

Bug 16185966

In prior releases of Oracle Rdb, attempts to reference sequences from multiple databases in the same query would not be correctly detected. Instead the referenced alias was ignored and the similarly named sequence in the target databases was used or an OBSOLETE_METADATA error was reported.

The following example shows these cases.

```
SQL> select test1.test_sequence.nextval, test2.test_sequence.nextval
cont> from test1.rdb$database;

                  322                   322
1 row selected
SQL>
SQL> select test2.new_sequence.nextval from test1.rdb$database;
%RDB−E−OBSOLETE_METADA, request references metadata objects that no longer exist
−RDMS−E−SEQNEXTS, sequence "NEW_SEQUENCE" does not exist in this database
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. SQL now correctly processes the alias on sequence references and prevents those references if they span multiple databases. Such errors will now produce an ONLONEDB error.

```
SQL> select test1.test_sequence.nextval, test2.test_sequence.nextval
cont> from test1.rdb$database;
%SQL−F−ONLONEDB, Only one database can be referred to in this statement
```

4.2.7 Unexpected RDMS−E−SEQNEXTS Error Reported When GRANT or REVOKE is Used on View

Bugs 16291753 and 16343330

Starting with Oracle Rdb Release 7.2.5.1, GRANT and REVOKE statements on tables with IDENTITY columns propagate these actions to the associated sequence that implements the IDENTITY for the table. Unfortunately, some nested view definitions are erroneously flagged as having identity sequences (these are actually reflections of the base table reference) and GRANT or REVOKE statements may fail.

The following example shows this behavior.

```
SQL> create table TAB (a integer identity);
SQL> create view VIW0 as select * from TAB;
SQL> create view VIW1 as select * from VIW0;
SQL> grant select on table * to smithi;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDB-E-OBSOLETE_METADA, request references metadata objects that no longer exist
-RDMS-E-SEQNEXTS, sequence "VIW0" does not exist in this database
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. Oracle Rdb no longer erroneously processes views that reference tables with identities.

4.2.8 Unexpected SQL−F−BADCORATT Error Reported by IMPORT DATABASE

In prior releases of Oracle Rdb, it is possible for the IMPORT to fail with SQL−F−BADCORATT error. This occurs under the following circumstances:

- The database is defined with PROTECTION IS ANSI.
- There are standalone external functions defined which are referenced by tables.
- These references require forward references so that the IMPORT DATABASE can proceed.

The following shows an example of the reported error.

```
SQL> import database
cont>     from ABC_EXP
cont>     filename ABC
cont> ;
%SQL-F-BADCORATT, invalid core attribute 00, 14 in .RBR file
%COSI-F-BUGCHECK, internal consistency failure
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The FORWARD_REFERENCES information includes the access control information for the routine that is to be declared at the start of the IMPORT DATABASE operation. This information is not ignored by the IMPORT DATABASE statement.

4.2.9 Rows Returned in the Wrong Order From Sorted Tactic During Bitmapped Scan

In some cases where the table cardinality is small and BITMAPPED SCAN is enabled, the selected Sorted strategy might be abandoned and rows returned in an unsorted order.

The following query, equivalent to the SHOW FUNCTIONS command, returns the routine names in the wrong order when the 'BITMAPPED SCAN' is enabled and using SORTED RANKED indices.

```
set flags 'bitmapped_scan';

select
    R.RDB$ROUTINE_NAME,
    (select M.RDB$MODULE_NAME
     from Rdb$MODULES M
     where M.RDB$MODULE_ID = R.RDB$MODULE_ID)
from
    Rdb$ROUTINES R
where
    R.Rdb$ROUTINE_ID > 0
order by R.Rdb$ROUTINE_NAME;
 RDB$ROUTINE_NAME
 TEST_WITHIN_DOMAIN                TEST_DOMAIN_MODULE
 TEST_TABLE                        TEST_TABLE_MODULE
 TEST_FUNC                         TEST_FUNCTION_MODULE
3 rows selected
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2.10 Unexpected RDMS−E−MAPLIMITORDBAD Error After Using ALTER DATABASE ... DROP STORAGE AREA ... CASCADE

Bug 16532358

In prior releases of Oracle Rdb, the ALTER DATABASE ... DROP STORAGE AREA ... CASCADE may implicitly drop a storage map if all storage areas referenced by that map are dropped. Unfortunately, in this case insufficient knowledge remains to locate and drop the storage mapping function created for the map and stored in Rdb$STORAGE_MAPS system module.

In such cases, a subsequent attempt to recreate the storage map with different partitioning limits attempts to re−use this (now) stale mapping routine. This could lead to the following error.

```
%RDB−E−NO_META_UPDATE, metadata update failed
−RDMS−F−MAPNOTDEF, map "TEST_MAP" has not been defined
−RDMS−E−MAPLIMITORDBAD, partition 1 limits are not in order for partitioned
table TEST_MAP
```

If the CREATE STORAGE MAP statement is preceded with a SET FLAGS 'STOMAP_STATS' statement, then a diagnostic message will point out the existence of a mapping routine.

```
SQL> create storage map TEST_MAP for TEST_TBL
cont>     partitioning is not updatable
cont>     placement via index TEST_IDX
cont>     store
cont>         using (col1)
cont>             in TEST3 with limit of ('BB')
cont>             in TEST4 with limit of ('CC');
~As: create storage map "TEST_MAP"
~As: Table "TEST_TBL" (sys=0, rest=0, tmptbl=0)
~As: found user defined routine named TEST_MAP − mapping routine not created
~As: Validation of Partition Ordering for Storage Map "TEST_MAP" on Table
"TEST_TBL"
~As: using function "TEST_MAP" to check vertical partition #1
%RDB−E−NO_META_UPDATE, metadata update failed
```

```
-RDMS-F-MAPNOTDEF, map "TEST_MAP" has not been defined
-RDMS-E-MAPLIMITORDBAD, partition 1 limits are not in order for partitioned
table TEST_MAP
```

A workaround for this problem is to first create a simple storage map that does not use WITH LIMIT TO clauses and then immediately drop that storage map. This has the side effect of removing the stale storage mapping routine.

This problem has now been corrected. The CREATE STORAGE MAP statement will now remove any old mapping routines matching the name of the storage map in the Rdb$STORAGE_MAPS module. If a routine exists with this name in a user defined module, it will not be deleted.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.2.11 IMPORT DATABASE Statement Was Ignoring NOTIFY IS DISABLED Clause

Bug 16869690

In prior releases of Oracle Rdb, the IMPORT DATABASE statement would ignore the NOTIFY IS DISABLED clause.

The following example shows that NOTIFY remains enabled after the IMPORT DATABASE statement.

```
SQL> create database
cont>     filename TESTING
cont>     notify is ENABLED
cont> ;
SQL>
SQL> export database
cont>     filename TESTING
cont>     into TESTING_EXP
cont> ;
SQL>
SQL> import database
cont>     from TESTING_EXP
cont>     filename TESTING
cont>     notify is disabled
cont> ;
SQL>
SQL> show database *
Default alias:
    Oracle Rdb database in file TESTING
.
.
.
        Notification:    Enabled
        Operator Class:
           Central
           Cluster
.
.
.
```

A workaround for this problem is to follow the IMPORT DATABASE statement with an ALTER

DATABASE FILENAME ... NOTIFY IS DISABLED statement.

This problem has been corrected in Oracle Rdb Release 7.2.5.3. The NOTIFY IS DISABLED is now correctly handled by the IMPORT DATABASE statement.

4.2.12 Unexpected RDB−E−INVALID_BLR Error Produced When ALTERNATE_OUTLINE_ID Is Active

Bug 16893170

In prior releases of Oracle Rdb, an unexpected INVALID_BLR error might be generated when the flag ALTERNATE_OUTLINE_ID was active for the session. This is set either using RDMS$SET_FLAGS logical or the SET FLAGS statement.

The following example shows the error being raised.

```
SQL> create database
cont>     filename ABC;
SQL>
SQL> create table TEST_T (c1 char(32) not null deferrable);
SQL> set flags 'alternate_outline_id(literals)';
SQL> insert into TEST_T values ('kapow');
%RDB−E−INVALID_BLR, request BLR is incorrect at offset 17
SQL>
SQL> commit;
```

The problem occurs when the referenced constraint is being processed.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3 RMU Errors Fixed

4.3.1 RMU/VERIFY/NOROOT Access Violation Verifying Client Sequences

Bug 14323013

If Client Sequences were defined in the Oracle Rdb database root, an access violation could occur when verifying the Client Sequences if the /NOROOT qualifier was specified for the RMU/VERIFY. This problem occurred when verifying that Client Sequence entries in the database root were consistent with the Client Sequences defined in the RDB$SEQUENCES system table. The only way to avoid this problem was to specify "/ROOT", the default, when verifying the database.

This problem has been fixed and now when the /NOROOT qualifier is specified for the RMU/VERIFY of a database with Client Sequences defined, the access violation will not occur when verifying that Client Sequence entries in the database root are consistent with the Client Sequences defined in the RDB$SEQUENCES system table.

The following example shows the problem. The TEST_DATABASE database being verified using the /NOROOT qualifier has a system access violation while verifying the Client Sequences defined in the database root with the Client Sequences defined in the RDB$SEQUENCES system table, outputs a dump file, and aborts the verification. If /ROOT (the default) had been specified for the RMU/VERIFY, the same diagnostic messages would have been output but no access violation would have occurred and the verify would have completed.

```
$ RMU/VERIFY/NOLOG  –
   /NOROOT –
   /TRANSACTION_TYPE=READ_ONLY –
   /INDEXES  –
   /DATA  –
   DEVICE:[DIRECTORY]TEST_DATABASE.RDB

%RMU–E–NOSEQROW, sequence id 23 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 25 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 26 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 27 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 28 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 29 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 30 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 36 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 57 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 58 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU–E–NOSEQROW, sequence id 59 has an entry in the root file but no row in
```

```
RDB$SEQUENCES
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
 virtual address=0000000000F86000, PC=000000000051CDA4, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_VER, Fatal error for VERIFY operation at 18-JUL-2012 15:40:36.13
$ TYPE DEVICE:[DIRECTORY]RMUBUGCHK.DMP

================================================================================
        Stack Dump Summary
================================================================================

***** Exception at 000000000051CDA4 : RMU721\RMUVERRDB$DB_QUERY + 000009B4
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
virtual address=0000000000F86000, PC=000000000051CDA4, PS=0000001B
Saved PC = 00000000003C1038 : RMU721\RMUVER$VERIFY + 000002F8
Saved PC = 00000000003B9784 : RMU721\RMU$VERIFY + 00001894
Saved PC = 00000000003B2794 : RMU721\RMU_DISPATCH + 00001554
Saved PC = 00000000003B0E0C : RMU721\RMU_STARTUP + 000004DC
Saved PC = 00000000001F0F24 : RMU721\RMU$MAIN + 00000034
Saved PC = 000000007AECF5D8 : Image DCL + 000935D8
```

The following example shows that this problem has been fixed. The TEST_DATABASE being verified using the /NOROOT qualifier does not have a system access violation while verifying the Client Sequences defined in the database root with the Client Sequences defined in the RDB$SEQUENCES system table and the database verify runs to completion.

```
$ RMU/VERIFY/NOLOG  -
   /NOROOT -
   /TRANSACTION_TYPE=READ_ONLY -
   /INDEXES  -
   /DATA  -
   DEVICE:[DIRECTORY]TEST_DATABASE.RDB

%RMU-E-NOSEQROW, sequence id 23 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 25 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 26 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 27 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 28 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 29 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 30 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 36 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 57 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 58 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-E-NOSEQROW, sequence id 59 has an entry in the root file but no row in
RDB$SEQUENCES
%RMU-I-REBLDSPAM, Space management (SPAM) pages should be rebuilt for
                  logical area TEST_AREA,
                  logical area id 4474
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.2 Missing Delimiters in Definitions Generated by RMU Extract

Bug 14779346

In prior releases of Oracle Rdb, RMU Extract failed to add quotes around some object names that required them.

- The SQL syntax generated for the ALTER TABLE ... ALTER COLUMN statement did not correctly delimit the column name.
- If a database used a character set other than DEC_MCS or ISOLATIN1, then names with leading digits were not delimited.

The following example shows these two problems.

```
$ RMU/EXTRACT/ITEM=TABLE TESTDB/OP=(NOHEADER,FILENAME_ONLY)
set verify;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 001, TIME 001;
attach 'filename TESTDB';
set default character set 'DEC_KANJI';
set literal character set 'DEC_KANJI';
set identifier character set 'DEC_KANJI';
set national character set 'DEC_KANJI';
set character length 'octets';
create table TEST1 (
    TEST#
        INTEGER
        constraint "TEST1_UNIQUE_TEST#"
            unique
            initially immediate not deferrable);

commit work;
```

These problems have been corrected in Oracle Rdb Release 7.2.5.3.

4.3.3 Unexpected ACCVIO from RMU Load When Constraint=DEFERRED is Used

Bug 15974633

In prior releases of Oracle Rdb, the use of the /CONSTRAINT=DEFERRED qualifier for RMU Load might result in an unending display of SYSTEM−F−ACCVIO errors and RMU bugchecks. This occurs when some portion of the RMU Load inputs are invalid, such as an incorrect number of columns being loaded. The reporting of the error causes RMU to erroneously try to verify the deferred constraints.

The following example shows this.

```
$ RMU /LOAD /COMMIT=1000 /CONS=DEFERRED -
/RECORD=( FILE=TSTDATA.RRD, FORMAT=DELIMIT, -
TERM="#", PREFIX="""", SUFFIX="""", NULL="", EXCEPT=TST.LOG) -
tstdata Tstrec tstdata.DAT
  DEFINE FIELD fld1 DATATYPE IS TEXT SIZE IS 6.
  DEFINE FIELD fld2 DATATYPE IS TEXT SIZE IS 13.
  DEFINE FIELD fld3 DATATYPE IS TEXT SIZE IS 13.
  DEFINE FIELD fld4 DATATYPE IS TEXT SIZE IS 13.
  DEFINE FIELD fld5 DATATYPE IS TEXT SIZE IS 13.
  DEFINE FIELD fld6 DATATYPE IS TEXT SIZE IS 13.
  DEFINE FIELD fld7 DATATYPE IS TEXT SIZE IS 13.
  define record tstrec.
   fld1.
   fld2.
   fld3.
   fld4.
   fld5.
   fld6.
   fld7.
  end tstrec record.

%RMU-F-FLDMUSMAT, Specified fields must match in number and datatype with the
unloaded data
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=0000000000000000, PC=0000000000465708, PS=0000001B
%RMU-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RMUBUGCHK.DMP;
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=0000000000000000, PC=0000000000465708, PS=0000001B
%RMU-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RMUBUGCHK.DMP;
...
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.4 RMU Did Not Sufficiently Verify the Database LOGFIL Structure

Bug 16169868

The LOGFIL structure in the Oracle Rdb database root file contains entries for different Rdb server log files. These entries can be initialized by the RMU/SET SERVER COMMAND. RMU/VERIFY did not verify the LOGFIL structure entries when it verified the database root. RMU/BACKUP did not verify the LOGFIL structure entries in the root before backing them up. RMU/RESTORE did not validate the LOGFIL structure entries in the RMU/BACKUP *.RBF backup file when restoring them. If LOGFIL entries were corrupt, bugchecks could occur when LOGFIL entries were accessed. No diagnostics were output which indicated the cause of the problem. Corruption of the LOGFIL entries in the database root could only be detected by an RMU/DUMP/HEADER of the database root file, an RMU/DUMP/BACKUP/OPTION=DEBUG of the backup *.RBF file, or by examining the RMUBUGCHK.DMP file created due to LOGFIL entry corruption.

This problem has been fixed and now the Rdb database LOGFIL entries are verified when the Rdb database root is verified, as well as the references to the LOGFIL structure in the database KROOT structure. This occurs both when the RMU/VERIFY command is executed and when the RMU/BACKUP command is executed. In addition, a consistency check is now done by RMU/RESTORE of the LOGFIL entries in the backup file.

The following example shows the problem. Since there was no code in RMU/RESTORE to validate the LOGFIL structure entries in the backup *.RBF file, RMU/RESTORE trusted an invalid log file entry type and this caused a system access violation. There also was no code in RMU/VERIFY or RMU/BACKUP to detect this LOGFIL structure corruption.

```
$ RMU/RESTORE/DIR=DEVICE:[TEST_DIR]/NOCDD/NOLOG TESTDB.RBF
%SYSTEM-F-ACCVIO, access violation, reason mask=04, virtual
        address=0000000000E21EB0, PC=FFFFFFFF81111A90, PS=0000001B
%RMU-I-BUGCHKDMP, generating bugcheck dump file DEVICE:[DIR]RMUBUGCHK.DMP;
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 31-JAN-2013 14:09:36.78
$ TYPE DEVICE:[DIR]RMUBUGCHK.DMP

================================================================================
        Stack Dump Summary
================================================================================

***** Exception at FFFFFFFF81111A90 : Image LIBOTS + 00021A90
%SYSTEM-F-ACCVIO, access violation, reason mask=04, virtual
        address=0000000000E21EB0, PC=FFFFFFFF81111A90, PS=0000001B
Saved PC = 0000000000360E74 : RMU72\RMUIO$DEBLOCK + 000007E4
Saved PC = 00000000003C3B64 : RMU72\RMURES$DUMP_SUMMARY_STATS + 000011E4
Saved PC = 00000000003C52CC : RMU72\RMURES$BF_RESTORE_THREAD + 0000022C
Saved PC = 00000000001F02FC : RMU72\RMUIO$TERMINATE_THREAD + 00000040
Saved PC = 00000000001F04B8 : RMU72\RMUIO$FIREWALL + 00000040
Saved PC = 00000000001F0478 : RMU72\RMUIO$FIREWALL + 00000000
Saved PC = 00000000003DE794 : RMU72\RMU_DISPATCH + 00000F84
Saved PC = 00000000003DD3DC : RMU72\RMU_STARTUP + 000004FC
Saved PC = 00000000001F0F24 : RMU72\RMU$MAIN + 00000034
Saved PC = 000000007AECF5D8 : Image DCL + 000935D8
```

The following example shows that RMU/RESTORE now does a basic validation of LOGFIL structure log file entries in the backup *.RBF file and aborts the restore operation if unrecoverable corruption is found.

```
$ RMU/RESTORE/DIR=DEVICE:[TEST_DIR]/NOCDD TESTDB.RBF
%RMU-F-INVLGFLTYPE, Invalid LOGFIL entry type of 301992960 in database root
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 31-JAN-2013 14:22:54.56
$ RMU/RESTORE/DIR=DEVICE:[TEST_DIR]/NOCDD TESTDB_2.RBF
%RMU-F-INVLGFLCNT, Invalid LOGFIL count of 3 in database root - expected 16
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 31-JAN-2013 14:22:54.56
```

The following example shows that RMU/VERIFY now verifies the LOGFIL structure log file entries in the database root. Previously, the LOGFIL structure was not verified.

```
$ RMU/VERIFY/ROOT/NOLOG TESTDB_3
%RMU-E-ROOLGFLCT, root "DEV:[TEST_DIR]TESTDB_3.RDB;1",
                  contains an invalid log file count
                  expected: 16, found: 3
%RMU-E-ROOLGFLTP, root "DEV:[TEST_DIR]TESTDB_3.RDB;1",
                  contains an invalid log file type
                  in log file entry 5
                  expected: 4, found: 301992960
RMU-W-ROOERRORS,        2 errors encountered in root verification
```

The following example shows that RMU/BACKUP now verifies the LOGFIL structure log file entries in the database root when it calls RMU/VERIFY to verify the database root at the start of the backup operation and

aborts the restore operation if unrecoverable corruption is found.

```
$ RMU/BACKUP/NOLOG TESTDB_4 TESTDB_4.RBF
%RMU-E-ROOLGFLCT, root "DEV:[TEST_DIR]TESTDB_4.RDB;1",
                  contains an invalid log file count
                  expected: 16, found: 3
%RMU-E-ROOLGFLTP, root "DEV:[TEST_DIR]TESTDB_4.RDB;1",
                  contains an invalid log file type
                  in log file entry 5
                  expected: 4, found: 301992960
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 31-JAN-2013 18:16:55.01
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.5 RMU/BACKUP/ONLINE/NOQUIET Did Not Backup the Root Log File Entries

Bug 16169868

The LOGFIL structure in the Oracle Rdb database root file contains entries for different Rdb server log files. These entries can be initialized by the RMU/SET SERVER COMMAND. Due to a problem with an RMU/BACKUP/ONLINE/NOQUIET backup, the log file entries in the root were not backed up to the *.RBF backup file. When the database was restored, the root log file entries were not corrupt but were missing and had to be redefined. This only happened if RMU/BACKUP/ONLINE/NOQUIET was specified for the backup.

This problem has been fixed and now RMU/BACKUP/ONLINE/NOQUIET correctly backs up the LOGFIL log file entries in the database root so that they are all restored correctly.

The following example shows the problem. A database is created and the RMU/SET SERVER command is used to create log file entries in the database root. A search of the database header before the database is backed up shows the six log file entries in the root. The database is then backed up using the RMU/BACKUP/ONLINE/NOQUIET command. A dump of the backup *.RBF file is then made. A search of the dump of the backup file shows that the six log file entries in the root have not been put in the backup *.RBF file. After the database is restored, a search of the database header shows that the six log file entries are missing from the root file of the restored database.

```
$ SQL
 CREATE DATABASE FILENAME TESTDB.RDB;
 EXIT
$ RMU /SET SERVER ABS/OUT=MY.ABS /NOLOG TESTDB.RDB
$ RMU /SET SERVER ALS/OUT=MY.ABS /NOLOG TESTDB.RDB
$ RMU /SET SERVER DBR/OUT=MY.DBR /NOLOG TESTDB.RDB
$ RMU /SET SERVER LCS/OUT=MY.LCS /NOLOG TESTDB.RDB
$ RMU /SET SERVER LRS/OUT=MY.LRS /NOLOG TESTDB.RDB
$ RMU /SET SERVER RCS/OUT=MY.RCS /NOLOG TESTDB.RDB
$ RMU /DUMP /HEADER /OUT=TESTDBBCKBAD.HDR TESTDB.RDB
$ SEAR TESTDBBCKBAD.HDR "LOG FILE #"
      Log File #5. is active
      Log File #6. is active
      Log File #7. is active
      Log File #8. is active
      Log File #9. is active
      Log File #10. is active
```

```
$ RMU/BACKUP/ONLINE/NOQUIET/NOLOG TESTDB.RDB TESTDB.RBF
$ RMU/DUMP/BACKUP/OPTION=DEBUG/OUTPUT=TESTDBONLBCKBAD.DMP TESTDB.RBF
$ SEAR TESTDBONLBCKBAD.DMP "LOGFIL LIST ENTRY"
%SEARCH-I-NOMATCHES, no strings matched
$ SQL
  DROP DATABASE FILENAME TESTDB.RDB;
  EXIT
$ RMU/RESTORE/NOCDD/NOLOG TESTDB.RBF
$ RMU /DUMP /HEADER /OUT=TESTDBRESBAD.HDR TESTDB.RDB
$ SEAR TESTDBRESBAD.HDR "LOG FILE #"
%SEARCH-I-NOMATCHES, no strings matched
```

The following example shows that the problem has been fixed. A database is created and the RMU/SET SERVER command is used to create log file entries in the database root. A search of the database header before the database is backed up shows the six log file entries in the root. The database is then backed up using the RMU/BACKUP/ONLINE/NOQUIET command. A dump of the backup *.RBF file is then made. A search of the dump of the backup file shows that the six log file entries in the root have now been put in the backup *.RBF file. After the database is restored, a search of the database header shows that the six log file entries have been restored correctly to the root file of the restored database.

```
$ SQL
 CREATE DATABASE FILENAME TESTDB;
 EXIT
$ RMU /SET SERVER ABS/OUT=MY.ABS /NOLOG TESTDB.RDB
$ RMU /SET SERVER ALS/OUT=MY.ABS /NOLOG TESTDB.RDB
$ RMU /SET SERVER DBR/OUT=MY.DBR /NOLOG TESTDB.RDB
$ RMU /SET SERVER LCS/OUT=MY.LCS /NOLOG TESTDB.RDB
$ RMU /SET SERVER LRS/OUT=MY.LRS /NOLOG TESTDB.RDB
$ RMU /SET SERVER RCS/OUT=MY.RCS /NOLOG TESTDB.RDB
$ RMU /DUMP /HEADER /OUT=TESTDBBCKGOOD.HDR TESTDB
$ SEAR TESTDBBCKGOOD.HDR "LOG FILE #"
      Log File #5. is active
      Log File #6. is active
      Log File #7. is active
      Log File #8. is active
      Log File #9. is active
      Log File #10. is active
$ RMU/BACKUP/ONLINE/NOQUIET/NOLOG TESTDB.RDB TESTDB.RBF
$ RMU/DUMP/BACKUP/OPTION=DEBUG/OUTPUT=TESTDBONLBCKGOOD.DMP TESTDB.RBF
$ SEAR TESTDBONLBCKGOOD.DMP "LOGFIL LIST ENTRY"
LOGFIL list entry
LOGFIL list entry
LOGFIL list entry
LOGFIL list entry
LOGFIL list entry
LOGFIL list entry
$ SQL
  DROP DATABASE FILENAME TESTDB;
  EXIT
$ RMU/RESTORE/NOCDD/NOLOG TESTDB.RBF
$ RMU /DUMP /HEADER /OUT=TESTDBRESGOOD.HDR TESTDB.RDB
$ SEAR TESTDBRESGOOD.HDR "LOG FILE #"
      Log File #5. is active
      Log File #6. is active
      Log File #7. is active
      Log File #8. is active
      Log File #9. is active
      Log File #10. is active
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.6 Unexpected RMU−F−NOSNAPS Error From RMU Collect Optimizer_Statistics

In prior releases of Oracle Rdb, the RMU Collect Optimizer_Statistics command would fail if the target database had SNAPSHOTS disabled. The default transaction mode is AUTOMATIC which should account for this state and only start READ WRITE transactions.

The following example shows the unexpected error.

```
$ RMU/COLLECT OPTIMIZER_STATISTICS/STAT=CARDINALITY DEBIT_CREDIT
Start loading tables... at 10−FEB−2013 21:08:35.89
Done loading tables.... at 10−FEB−2013 21:08:35.91
Start loading indexes... at 10−FEB−2013 21:08:35.91
Done loading indexes.... at 10−FEB−2013 21:08:35.92
%RMU−F−NOSNAPS, snapshots are not allowed or not enabled for area
USER1:[TESTER]DEBIT_CREDIT.RDA;1
%RMU−F−FTL_COL_STAT, Fatal error for COLLECT OPTIMIZER_STATISTICS operation
at 10−FEB−2013 21:08:35.93
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. RMU now correctly handles a database with snapshots disabled.

4.3.7 Encrypted Parallel Backup Files Could Not Be Restored Or Dumped

Bug 16355377

Encrypted parallel backup RBF files could not be restored or dumped because of an RMU/RESTORE and RMU/DUMP/BACKUP problem decrypting encrypted backup files created by a parallel backup of an Oracle Rdb database. The backup files were encrypted correctly. The problem was only with the decryption of the database backup files produced by a parallel backup.

This problem has now been fixed and encrypted database parallel backup files can now be restored by RMU/RESTORE and dumped by RMU/DUMP/BACKUP. Fixing this problem requires storing the information that encrypted backup files are being created by a parallel backup in the backup files created when the RMU/BACKUP/PARALLEL command is executed. To allow encrypted backup files produced by parallel backups in previous versions of RDB to be correctly decrypted, a new PARALLEL_BACKUP option has been added to the existing /ENCRYPT qualifier options that can only be used with the RMU/RESTORE and RMU/DUMP/BACKUP commands. This new option cannot be negated.

```
/ENCRYPT=(PARALLEL_BACKUP,...)
```

This new option should only be used for encrypted backup files created by parallel backups executed in previous versions of Rdb. It should not be used for encrypted backup files created by parallel backups in this version (Rdb 7.2.5.3) or future versions of Rdb (such as the 7.3 versions).

The following example shows the problem. The parallel backup command correctly encrypts the backup file saveset MFP.RBF and MFP01.RBF produced by a parallel backup of the MF_PERSONNEL database, but because of the decryption problem both an RMU/DUMP/BACKUP command and an RMU/RESTORE command get errors when they try to decrypt the second encrypted file of the parallel backup saveset,

MFP01.RBF.

```
$ RMU/BACKUP/ENCRYPT=(NAME=TEST_KEY)/PARALLEL=(EXECUTOR_COUNT=2) -
                    /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
                    /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
                    /LIST_PLAN=MFP.PLAN/NOLOG -
                       DEVICE:[TEST.PARBCK.DB]MF_PERSONNEL.RDB -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$ RMU/DUMP/BACKUP/ENCRYPT=(NAME=TEST_KEY)/DISK_FILE/OPTION=DEBUG -
                    /OUTPUT=PARBCKDMP.DMP -
                    DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                    DEVICE:[TEST.PARBCK.B2]
%RMU-E-INVRECSIZ, invalid record size in backup file
%RMU-F-FATALERR, fatal error on DUMP_BACKUP
%RMU-F-FTL_DUMP, Fatal error for DUMP operation at  5-MAR-2013 11:24:16.44
$ RMU/RESTORE/ENCRYPT=(NAME=TEST_KEY)/NOCDD/DISK_FILE=READER_THREADS=1/NOLOG -
               /DIR=DEVICE:[TEST.PARBCK] -
               /ROOT=DEVICE:[TEST.PARBCK]MF_PERSONNEL.RDB -
               /NOAIJ/NORECOVERY -
                    DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                    DEVICE:[TEST.PARBCK.B2]
%RMU-E-READERR, error reading DEVICE:[TEST.PARBCK.B2]MFP01.RBF;
-RMU-E-BLOCKCRC, software block CRC error
%RMU-E-READERR, error reading DEVICE:[TEST.PARBCK.B2]MFP01.RBF;
-RMU-E-BLOCKCRC, software block CRC error
%RMU-E-INVRECSIZ, invalid record size in backup file
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at  5-MAR-2013 11:24:24.67
```

The following example shows that this problem has been fixed. Now both the RMU/DUMP/BACKUP command and the RMU/RESTORE command succeed when they decrypt the two files of the parallel backup saveset, MFP.RBF and MFP01.RBF.

```
$ RMU/BACKUP/ENCRYPT=(NAME=TEST_KEY)/PARALLEL=(EXECUTOR_COUNT=2) -
                    /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
                    /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
                    /LIST_PLAN=MFP.PLAN/NOLOG -
                       DEVICE:[TEST.PARBCK.DB]MF_PERSONNEL.RDB -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$ RMU/DUMP/BACKUP/ENCRYPT=(NAME=TEST_KEY)/DISK_FILE/OPTION=DEBUG -
                    /OUTPUT=PARBCKDMP.DMP -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$ RMU/RESTORE/ENCRYPT=(NAME=TEST_KEY)/NOCDD/DISK_FILE=READER_THREADS=1/NOLOG -
                    /DIR=DEVICE:[TEST.PARBCK] -
                    /ROOT=DEVICE:[TEST.PARBCK]MF_PERSONNEL.RDB -
                    /NOAIJ/NORECOVERY -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$
```

The following example shows the new PARALLEL_BACKUP option that can only be specified with the /ENCRYPT qualifier used with the RMU/RESTORE and RMU/DUMP/BACKUP commands. This option should only be specified for parallel backup RBF files created by previous versions of Rdb. It is not necessary to use this option for this and future versions of Rdb.

```
$ RMU/BACKUP/ENCRYPT=(NAME=TEST_KEY)/PARALLEL=(EXECUTOR_COUNT=2) -
```

```
                    /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
                    /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
                    /LIST_PLAN=MFP.PLAN/NOLOG -
                       DEVICE:[TEST.PARBCK.DB]MF_PERSONNEL.RDB -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$ RMU/DUMP/BACKUP/ENCRYPT=(NAME=TEST_KEY,PARALLEL_BACKUP)/DISK_FILE
                    /OPTION=DEBUG -
                    /OUTPUT=PARBCKDMP.DMP -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$ RMU/RESTORE/ENCRYPT=(NAME=TEST_KEY,PARALLEL_BACKUP)/NOCDD
                    /DISK_FILE=READER_THREADS=1/NOLOG -
                    /DIR=DEVICE:[TEST.PARBCK] -
                    /ROOT=DEVICE:[TEST.PARBCK]MF_PERSONNEL.RDB -
                    /NOAIJ/NORECOVERY -
                       DEVICE:[TEST.PARBCK.B1]MFP.RBF, -
                       DEVICE:[TEST.PARBCK.B2]
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.8 Character Set Restriction on ORDER_BY_NAME Option Has Been Removed

Bug 16496618

In prior releases of Oracle Rdb, the RMU Extract command would ignore the Option=Order_By_Name when the identifier character set for the database was not ASCII, DEC_MCS or one of the ISOLATIN character sets.

This restriction was unnecessary because SQL restricts the storage area names to be strictly uppercase ASCII. Therefore, this restriction has been removed from RMU Extract.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.9 RMU/DUMP/BACKUP Could Output Invalid Data Page TSN Numbers

The RMU/DUMP/BACKUP command could output invalid Oracle Rdb data page transaction sequence identifier (TSN) numbers which did not match TSN numbers actually stored in the database backup (RBF) file created by the RMU/BACKUP command. This happened because information in the data page tail needed for correctly formatting the TSN numbers could be incorrectly accessed by the RMU/DUMP/BACKUP command. This problem was only a problem with the data page TSN numbers output by RMU/DUMP/BACKUP. The data page TSN numbers stored in the backup file and on the backed up database pages were valid.

This problem has been fixed. Now all the data page TSN numbers output by the RMU/DUMP/BACKUP command are valid and match the data page TSN numbers stored in the database backup file.

The following example shows the problem. Note that only data which directly demonstrates this problem is shown in this example. The TSNs in the data page TSN line index and the data page tail shown in the dump of

the backup file for data page 196 in storage area 1 for the MF_PERSONNEL database do not match the TSN values actually stored in the backup file and displayed in the dump of the same page in the actual database.

```
$ RMU/BACKUP MF_PERSONNEL MFP.RBF
$ RMU/DUMP/BACKUP/OPTION=DEBUG/OUT=MFP.DMP MFP.RBF
$ TYPE MFP.DMP

REC_SIZE = 56             REC_TYPE = 7              BADDATA = 00
ROOT = 00                 AREA_ID = 1               LAREA_ID = 2
PNO = 196                 SPAM_VALUE = 208

Data page 196. header record of 56. bytes

                  0001 000000C4  0000  page 196, physical area 1
                       4253CAE0  0006  checksum = 4253CAE0
              00A66EB9 DFB18856  000A  time stamp = 30-APR-2007 14:11:13.49
                       0000 0076  0012  118 free bytes, 0 locked
                            0004  0016  4 lines
                       00D0 031E  0018  line 0: offset 031E, 208 bytes
                       00D0 024E  001C  line 1: offset 024E, 208 bytes
                       00D0 017E  0020  line 2: offset 017E, 208 bytes
                       00D0 00AE  0024  line 3: offset 00AE, 208 bytes

                        00000020  0028  line 0: TSN 10737418272
                        00000020  002C  line 1: TSN 10737418272
                        00000020  0030  line 2: TSN 10737418272
                        00000020  0034  line 3: TSN 10737418272

REC_SIZE = 850            REC_TYPE = 8              BADDATA = 00
ROOT = 00                 AREA_ID = 1               LAREA_ID = 2
PNO = 196

Data page 196. content record of 850. bytes

                        FFFFFFFF  0008  snap page pointer -1
                        00000020  000C  snap pointer TSN 3752133449
                            0002  0010  logical area 2
                        00000000  0012  page sequence number 0
                            0000  0016  page TSN base 0
                            0000  0018  MBZ '..'

$ RMU/DUMP/AREA=1/START=196/END=196 MF_PERSONNEL

                  0001 000000C4  0000  page 196, physical area 1
                       4253CAE0  0006  checksum = 4253CAE0
              00A66EB9 DFB18856  000A  time stamp = 30-APR-2007 14:11:13.49
                       0000 0076  0012  118 free bytes, 0 locked
                            0004  0016  4 lines
                       00D0 031E  0018  line 0: offset 031E, 208 bytes
                       00D0 024E  001C  line 1: offset 024E, 208 bytes
                       00D0 017E  0020  line 2: offset 017E, 208 bytes
                       00D0 00AE  0024  line 3: offset 00AE, 208 bytes

                        00000020  0028  line 0: TSN 32
                        00000020  002C  line 1: TSN 32
                        00000020  0030  line 2: TSN 32
                        00000020  0034  line 3: TSN 32


                        FFFFFFFF  03EE  snap page pointer -1
                        00000020  03F2  snap pointer TSN 32
                            0002  03F6  logical area 2
```

```
                    00000000  03F8  page sequence number 0
                        0000  03FC  page TSN base 0
                        0000  03FE  MBZ '..'
```

The following example shows that this problem has been fixed. Note that only data which directly demonstrates that this problem has been fixed is shown in this example. The TSNs in the data page TSN line index and the data page tail shown in the dump of the backup file for data page 196 in storage area 1 for the MF_PERSONNEL database now match the TSN values actually stored in the backup file and displayed in the dump of the same page in the actual database.

```
$ RMU/BACKUP MF_PERSONNEL MFP.RBF
$ RMU/DUMP/BACKUP/OPTION=DEBUG/OUT=MFP.DMP MFP.RBF
$ TYPE MFP.DMP

REC_SIZE = 56             REC_TYPE = 7              BADDATA = 00
ROOT = 00                 AREA_ID = 1               LAREA_ID = 2
PNO = 196                 SPAM_VALUE = 208

Data page 196. header record of 56. bytes

                0001 000000C4  0000  page 196, physical area 1
                     4253CAE0  0006  checksum = 4253CAE0
            00A66EB9 DFB18856  000A  time stamp = 30-APR-2007 14:11:13.49
                     0000 0076  0012  118 free bytes, 0 locked
                          0004  0016  4 lines
                     00D0 031E  0018  line 0: offset 031E, 208 bytes
                     00D0 024E  001C  line 1: offset 024E, 208 bytes
                     00D0 017E  0020  line 2: offset 017E, 208 bytes
                     00D0 00AE  0024  line 3: offset 00AE, 208 bytes

                      00000020  0028  line 0: TSN 32
                      00000020  002C  line 1: TSN 32
                      00000020  0030  line 2: TSN 32
                      00000020  0034  line 3: TSN 32

REC_SIZE = 850            REC_TYPE = 8              BADDATA = 00
ROOT = 00                 AREA_ID = 1               LAREA_ID = 2
PNO = 196

Data page 196. content record of 850. bytes

                      FFFFFFFF  0008  snap page pointer -1
                      00000020  000C  snap pointer TSN 32
                          0002  0010  logical area 2
                      00000000  0012  page sequence number 0
                          0000  0016  page TSN base 0
                          0000  0018  MBZ '..'

$ RMU/DUMP/AREA=1/START=196/END=196 MF_PERSONNEL

                0001 000000C4  0000  page 196, physical area 1
                     4253CAE0  0006  checksum = 4253CAE0
            00A66EB9 DFB18856  000A  time stamp = 30-APR-2007 14:11:13.49
                     0000 0076  0012  118 free bytes, 0 locked
                          0004  0016  4 lines
                     00D0 031E  0018  line 0: offset 031E, 208 bytes
                     00D0 024E  001C  line 1: offset 024E, 208 bytes
                     00D0 017E  0020  line 2: offset 017E, 208 bytes
                     00D0 00AE  0024  line 3: offset 00AE, 208 bytes

                      00000020  0028  line 0: TSN 32
```

```
00000020  002C  line 1: TSN 32
00000020  0030  line 2: TSN 32
00000020  0034  line 3: TSN 32


FFFFFFFF  03EE  snap page pointer -1
00000020  03F2  snap pointer TSN 32
    0002  03F6  logical area 2
00000000  03F8  page sequence number 0
    0000  03FC  page TSN base 0
    0000  03FE  MBZ '..'
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.10 RMU/BACKUP/PARALLEL/DISK_FILE Problem Expanding Directory Specifications

The RMU/BACKUP/PARALLEL/DISK_FILE command did not properly expand the backup file set directory specifications. This caused a fatal error which aborted the parallel backup command execution if an incomplete backup file directory specification was specified. This problem has now been fixed. To avoid this problem, always specify complete backup file set directory specifications with the RMU/BACKUP/PARALLEL/DISK_FILE command.

The following example shows the problem. The RMU/BACKUP/PARALLEL/DISK_FILE command specifies the incomplete backup file set directories "[.G1]" and "[.G2]". These incomplete backup file set directories are incorrectly expanded to an invalid directory specification. This causes a fatal error to be output and the backup operation is aborted.

```
$ RMU/BACKUP/PARALLEL=(EXECUTOR_COUNT=2) -
        /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
        /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
        /LIST_PLAN=MFP.PLAN/NOLOG -
        MF_PERSONNEL.RDB -
        [.G1]MFP.RBF, -
        [.G2]
%RMU-F-FILACCERR, error opening output file DEVICE:[INVALID_DIR.G1]MFP.RBF;
-RMS-E-DNF, directory not found
-SYSTEM-W-NOSUCHFILE, no such file
%RMU-F-FATALERR, fatal error on BACKUP
%RMU-F-FTL_RMU, Fatal error for RMU operation at 9-APR-2013 11:03:54.63
$
```

The following example shows that this problem has been fixed. The RMU/BACKUP/PARALLEL/DISK_FILE command specifies the incomplete backup file set directories "[.G1]" and "[.G2]". These incomplete backup file set directories are expanded correctly and now the backup operation completes successfully.

```
$ RMU/BACKUP/PARALLEL=(EXECUTOR_COUNT=2) -
        /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
        /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
        /LIST_PLAN=MFP.PLAN/NOLOG -
        MF_PERSONNEL.RDB -
        [.G1]MFP.RBF, -
        [.G2]
$
```

The following example shows the workaround to use for this problem. If complete backup file set directory specifications are used, the backup operation completes successfully.

```
$ RMU/BACKUP/PARALLEL=(EXECUTOR_COUNT=2) -
        /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
        /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
        /LIST_PLAN=MFP.PLAN/NOLOG -
        MF_PERSONNEL.RDB -
        DEVICE:[DIRECTORY.G1]MFP.RBF, -
        DEVICE:[DIRECTORY.G2]
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.11 The RMU/BACKUP/PLAN/LIST_PLAN Command Created an Invalid Backup Plan File

The Oracle Rdb RMU/BACKUP/PLAN command /LIST_PLAN qualifier creates a new backup plan file, based on the RMU/BACKUP/PLAN command parameter which is an existing backup plan file specification, but with place holder comments added for new or existing backup command qualifiers which are not in the original backup plan file.

There was a problem which caused a new invalid backup plan file to be created by the RMU/BACKUP/PLAN/LIST_PLAN command which left out some of the information contained in the original valid plan file. When executed to backup the database, the new invalid backup plan file would cause the database backup to fail.

This problem has now been fixed and a valid new plan file is created by the /LIST_PLAN qualifier when used with the RMU/BACKUP/PLAN command. Note that this problem did not happen with the /LIST_PLAN qualifier used with the RMU/BACKUP/PARALLEL command.

The following example shows the problem. The RMU/BACKUP/PARALLEL command does not execute the database backup but uses the /LIST_PLAN qualifier to create the valid backup plan file MFP.PLAN. The first RMU/BACKUP/PLAN command also does not execute the database backup but creates a new but invalid backup plan file based on the valid backup plan file. The VMS DIFF command shows that information that was in the original valid plan file is missing in the new invalid plan file. When the invalid new plan file is then executed using the RMU/BACKUP/PLAN command, the backup fails because of the missing data in the new invalid backup plan file. In fact, the missing data causes the original MULTIFILE backup plan to now be an invalid TAPE backup plan.

```
$ RMU/BACKUP/PARALLEL=(EXECUTOR=2)/NOEXECUTE -
_$ /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
_$ /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
_$ /LIST_PLAN=MFP.PLAN/LOG -
_$ DEVICE:[DIRECTORY]MF_PERSONNEL.RDB -
_$ DEVICE:[DIRECTORY.B1]MFP.RBF, -
_$ DEVICE:[DIRECTORY.B2]
$ RMU/BACKUP/PLAN/NOEXECUTE/LIST_PLAN=MFP_NEW.PLAN MFP.PLAN
$ DIFF MFP.PLAN MFP_NEW.PLAN
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   10       Style = Multifile
   11       FixedDisks
   12       !   Max_file_size = megabytes per backup file
```

```
   13       PromptAutomatic
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   10       Style = Normal
   11       PromptAutomatic
************
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   26       Page_Buffers = 5
   27       ! Allocation_Quantity = number of blocks for initial backup file
              allocation
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   24       ! Page_Buffers = number of buffers to use for each storage area
   25       ! Allocation_Quantity = number of blocks for initial backup file
              allocation
************
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   31       NoIncremental
   32       ! Accept_labels preserves all tape labels
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   29       Incremental
   30       ! Accept_labels preserves all tape labels
************
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   40       Encrypt = (Name="MAGTAPE_KEY",Algorithm="DESCBC")
   41       NoRewind
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   38       NoRewind
************
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   64       Writer_threads = 1
   65       Directory List
   66           DEVICE:[DIRECTORY.B1]
   67       End Directory List
   68   End Executor Parameters
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   61       Tape Drive List
   62       End Tape Drive List
   63   End Executor Parameters
************
************
File DEVICE:[DIRECTORY]MFP.PLAN;28
   80       Writer_threads = 1
   81       Directory List
   82           DEVICE:[DIRECTORY.B2]
   83       End Directory List
   84   End Executor Parameters
******
File DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
   75       Tape Drive List
   76       End Tape Drive List
   77   End Executor Parameters
************
Number of difference sections found: 6
Number of difference records found: 14
```

```
DIFFERENCES /MERGED=1-
    DEVICE:[DIRECTORY]MFP.PLAN;28-
    DEVICE:[DIRECTORY]MFP_NEW.PLAN;1

$ RMU/BACKUP/PLAN MFP_NEW.PLAN
%RMU-E-PLNSLVTD, Executor WORKER_001 has no tape drives assigned.
%RMU-E-PLNSLVTD, Executor WORKER_002 has no tape drives assigned.
WORKER_001: %RMU-F-FTL_RMU, Fatal error for RMU operation at 3-MAY-2013
11:37:21.93
WORKER_002: %RMU-F-FTL_RMU, Fatal error for RMU operation at 3-MAY-2013
11:37:21.93
```

The following example shows that this problem has been fixed. Now the first RMU/BACKUP/PLAN command does not execute the backup but creates the valid new database backup plan file MFP_NEW.PLAN based on the original valid MFP.PLAN database backup plan file. The VMS DIFF command shows no differences between the two plan files. When the second RMU/BACKUP/PLAN command executes the new valid MFP_NEW.PLAN file, the database backup succeeds.

```
MALIBU>RMU/BACKUP/PLAN/NOEXECUTE/LIST_PLAN=MFP_NEW.PLAN MFP.PLAN
MALIBU>DIFF MFP.PLAN MFP_NEW.PLAN
Number of difference sections found: 0
Number of difference records found: 0

DIFFERENCES /MERGED=1-
    DEVICE:[DIRECTORY]MFP.PLAN;1-
    DEVICE:[DIRECTORY]MFP_NEW.PLAN;1
MALIBU>RMU/BACKUP/PLAN MFP_NEW.PLAN
%RMU-I-QUIETPT, waiting for database quiet point at  3-MAY-2013 11:44:40.52
%RMU-I-RELQUIETPT, Database quiet point lock has been released at 3-MAY-2013
11:44:40.56.
WORKER_001: %RMU-I-QUIETPT, waiting for database quiet point at 3-MAY-2013
11:44:40.60
WORKER_002: %RMU-I-QUIETPT, waiting for database quiet point at 3-MAY-2013
11:44:40.60
WORKER_001: %RMU-I-RELQUIETPT, Database quiet point lock has been released at
3-MAY-2013 11:44:40.60.
WORKER_002: %RMU-I-RELQUIETPT, Database quiet point lock has been released at
3-MAY-2013 11:44:40.61.
WORKER_001: %RMU-I-BCKTXT_00, Backed up root file
DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
WORKER_002: %RMU-I-RESUME, resuming operation on volume 2 using _$1$DGA220
WORKER_001: %RMU-I-BCKTXT_02, Starting full backup of storage area (RDB$SYSTEM)
DEVICE:[DIRECTORY]MF_PERS_DEFAULT.RDA;1 at  3-MAY-2013 11:44:40.80
WORKER_001: %RMU-I-BCKTXT_12, Completed full backup of storage area
(RDB$SYSTEM)
DEVICE:[DIRECTORY]MF_PERS_DEFAULT.RDA;1 at  3-MAY-2013 11:44:40.88
WORKER_002: %RMU-I-BCKTXT_02, Starting full backup of storage area
(SALARY_HISTORY)
DEVICE:[DIRECTORY]SALARY_HISTORY.RDA;1 at  3-MAY-2013 11:44:40.81

WORKER_001: %RMU-I-BCKTXT_12, Completed full backup of storage area
(EMPIDS_OVER)
DEVICE:[DIRECTORY]EMPIDS_OVER.RDA;1 at3-MAY-2013 11:44:40.99
WORKER_001: %RMU-I-BCKTXT_12, Completed full backup of storage area
(EMPIDS_LOW)
DEVICE:[DIRECTORY]EMPIDS_LOW.RDA;1 at  3-MAY-2013 11:44:40.99
WORKER_001: %RMU-I-BCKTXT_12, Completed full backup of storage area
(MF_PERS_SEGSTR)
DEVICE:[DIRECTORY]MF_PERS_SEGSTR.RDA;1 at  3-MAY-2013 11:44:40.99
WORKER_002: %RMU-I-COMPLETED, BACKUP operation completed at 3-MAY-2013
```

```
11:44:41.00
WORKER_001: %RMU-I-COMPLETED, BACKUP operation completed at 3-MAY-2013
11:44:41.00
%RMU-I-COMPLETED, BACKUP operation completed at  3-MAY-2013 11:44:41.00
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.3.12 Script Generated by RMU Extract Has Syntax Error in ALERT OPERATOR Clause

Bug 16875931

In prior releases of Oracle Rdb, the RMU/EXTRACT command might generate invalid syntax for the ALERT OPERATOR clause of the NOTIFY IS ENABLED clause.

The following example uses the SQL script created by RMU Extract which results in a syntax error.

```
$       RMU/EXTRACT-
            /ITEM=IMPORT-
            /DEFAULTS=(NOALLOCATION,NOSNAPSHOT_ALLOCATION)-
            /OPTION=(NOHEADER,FILENAME_ONLY)-
            /OUTPUT=AFTER.SQL-
        TEST_DB
$
$       DEFINE/USER rmuextract_rbr TEST_DB_EXP
$       SQL$

drop database
    filename TEST_DB
;

@after.sql;
SQL> set verify;
SQL> set language ENGLISH;
SQL> set default date format 'SQL92';
SQL> set quoting rules 'SQL92';
SQL> set date format DATE 001, TIME 001;
SQL> import database from rmuextract_rbr
cont>     filename 'TEST_DB'
.
.
.
cont>     prestarted transactions are ON
cont>     notify is ENABLED
cont>         (alert operator central + console + disk + cluster
cont>          + security + oper1 + oper2 + oper3 + oper4 + oper5 + oper6
cont>          + oper7 + oper8 + oper9 + oper10 + oper11 + oper12 + tape)
         + oper7 + oper8 + oper9 + oper10 + oper11 + oper12 + tape)
                                                               ^
%SQL-W-LOOK_FOR_STT, Syntax error, looking for:
%SQL-W-LOOK_FOR_CON,            NO, ALL, NONE, DISKS, OPER1, OPER2,
%SQL-W-LOOK_FOR_CON,            OPER3, OPER4, OPER5, OPER6, OPER7,
%SQL-W-LOOK_FOR_CON,            OPER8, OPER9, OPER10, OPER11, OPER12,
%SQL-W-LOOK_FOR_CON,            CENTRAL, CLUSTER, CONSOLE, SECURITY,
%SQL-F-LOOK_FOR_FIN,    found TAPE instead
.
.
.
```

This problem results from using the command RMU/SET AFTER_JOURNAL/NOTIFY=ALL. RMU sets all the possible operator notify flags supported by OpenVMS, even those not currently supported by Oracle Rdb. RMU/EXTRACT using either /ITEM=DATABASE or /ITEM=IMPORT erroneously emits the TAPE keyword.

Apart from editing the generated scripts from RMU Extract, another solution is to clear those unused operator notify flags.

```
$ RMU/SET AFTER/NONOTIFY TEST_DB
```

Then replace them with the subset supported by Rdb.

```
$ RMU/SET AFTER/NOTIFY=(-
    CENTRAL,CONSOLE,DISK,CLUSTER,SECURITY,OPER1-
    ,OPER2,OPER3,OPER4,OPER5,OPER6,OPER7,OPER8,OPER9-
    ,OPER10,OPER11,OPER12) -
    TEST_DB
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. RMU/EXTRACT using either /ITEM=DATABASE or /ITEM=IMPORT qualifiers will now only generate legal syntax for the ALERT OPERATOR clause. In addition, RMU Extract will abbreviate the list of operator notify flags to ALL instead of listing all possible flags.

4.3.13 RMU/LOAD Sometimes Stores Records In Overflow Partition

Bug 16315422

When using RMU/LOAD to load large data records (larger than 16k bytes), some rows may have been loaded into the wrong partition. This occurred because Rdb erroneously interpreted the partitioning column as NULL.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.4 RMU Show Statistics Errors Fixed

4.4.1 RMU/SHOW STATISTICS (TRANSACTION DURATION (TOTAL)) Playback Generates a Bugcheck

Bug 14549269

In prior versions of Oracle Rdb, the RMU Show Statistics (Transaction Duration (Total)) screen on Integrity systems generates a bugcheck with an arithmetic trap.

```
%SYSTEM-F-INTDIV, arithmetic trap, integer divide by zero at
PC=FFFFFFFF80A91E51, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file DISK1:[TESTING]RMUBUGCHK.DMP;
%RMU-F-FTL_SHOW, Fatal error for SHOW operation at 24-AUG-2012 06:29:45.45
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. RMU Show Statistics no longer generates a fatal error for this screen.

4.4.2 %SMG−F−INVROW in RMU/SHOW STAT Using Option WRITE REPORT GRAPH or WRITE BOTH

Bug 14807019

When using RMU/SHOW STATISTICS on a database (e.g. MF_PERSONNEL) and doing M (Menu), then a letter that gives a screen in which you can choose O (Option) to write a Report with Graphs or Numbers or Both, and you choose A (graph) or C (Both), the report is written partially and then RMU/SHOW STATISTICS crashes with the following error message:

```
%SMG-F-INVROW, invalid row
 %RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-F-FTL_SHOW, Fatal error for SHOW operation <<DATE & TIME >>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.3. RMU Show Statistics no longer generates an invalid row fatal error for this screen.

4.4.3 Unable to Start RMU/SHOW STATISTICS During Cluster State Transition

Bug 14582053

In prior versions of Oracle Rdb, an attempt to run RMU/SHOW STATISTICS during a cluster state transition would cause the process to hang until the transition was complete.

Under normal circumstances, if an Rdb database, opened on multiple cluster members, was abnormally closed on one node with active users, a Database Recovery process (DBR) would be initiated on another node to recover those failed users. The abnormal closure could be caused by a number of situations including: node

failure, Rdb monitor failure, or an RMU/CLOSE/ABORT=DELPRC command.

During this recovery period, all database processes are frozen and new attaches (including RMU/SHOW STATISTICS) are stalled. When the recovery completes, the database has normalized and activity can continue on the remaining available nodes (cluster state transition).

In very rare circumstances, it may be possible for the DBR process to become stalled, typically on an undetected deadlock. If the RMU SHOW/STATISTICS utility had been able to start, the "Stall Messages" and "DBR Activity" screens could help determine the nature of the stall, and the Tools facility could be used to terminate the processes blocking the DBR.

This problem has now been corrected in Oracle Rdb Release 7.2.5.3. RMU/SHOW STATISTICS is no longer subject to the freeze protocol and thus can start and collect information even when there is a stalled recovery process.

4.4.4 Unexpected Bugcheck Dump From RMU/SHOW STATISTICS/HOT_STANDBY_LOG

Bug 15883785

In prior versions of Oracle Rdb, the RMU Show Statistics command with /Hot_Standby_Log qualifier might generate an access violation (ACCVIO) and produce a bugcheck dump. The bugcheck summary would be similar to this example:

- Itanium OpenVMS 8.4
- Oracle Rdb Server 7.2.5.2.0
- Got a RMUBUGCHK.DMP
- SYSTEM−F−ACCVIO, access violation, virtual address=0000000050435400
- Exception occurred at symbol not found
- Called from RMU72\KUTDIS$HS_NOTIFY + 00000840
- Called from RMU72\KUTDIS$EVENT_NOTIFY + 00000220
- Called from RMU72\KUTDIS$DISPLAY_ASTX + 00000D00
- Running image RMU72.EXE
- Command line was: RMU/SHOW STATI/TIME=5/NOINTERACTIVE−
- /UNTIL=14−NOV−2012 16:59:35.42/HOT_STANDBY=SYS$LOGIN:GET_HS.LOG TEST_DATABASE

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

4.4.5 Problem Viewing RMU/SHOW STATISTICS 'LOGMINER INFORMATION' Screen

Bug 16732816

A problem was introduced in Oracle Rdb Release 7.2.5.2 that caused RMU/SHOW STATISTICS to display invalid data in the "MQP_TSN" and "LastTSN" fields on the "LOGMINER INFORMATION" screen.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

Chapter 5
Software Errors Fixed in Oracle Rdb Release 7.2.5.2

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.2.

5.1 Software Errors Fixed That Apply to All Interfaces

5.1.1 Orphan LIST Segments on Integrity Systems

In prior releases of Oracle Rdb V7.2 for Integrity systems, deleting of LIST OF BYTE VARYING column data was not performed when assigning a NULL value to the column. See the following example.

```
SQL> update RESUMES
cont> set resume = NULL
cont> where last_name = 'Smith';
1 row updated
SQL>
```

This statement correctly sets the column to NULL but the old LIST OF BYTE VARYING data is not correctly deleted. This problem includes actions by the DROP TABLE and ALTER TABLE ... DROP COLUMN statements which use this technique to erase the LIST segments prior to updating the metadata in the system tables.

The result of this error is that orphan LIST segments remain in the database and cannot be removed except by a database unload or reload.

Note that this problem does not exist on Alpha versions of Oracle Rdb. A normal DELETE of a row does not exhibit this problem.

Symptoms of this problem include:

- An unexpected SSAREANOTEMPT error may be observed when trying to drop a LIST OF BYTE VARYING column as shown in this example.

  ```
  SQL> set flags 'stomap_stats';
  SQL> alter table resumes
  cont>     drop column resume cascade;
  ~As: Retrieve all column "RESUME" pointers from table "RESUMES"
  ~As: list partition RESUME_LISTS (1) is now empty
  %RDB-E-NO_META_UPDATE, metadata update failed
  -RDMS-E-SSAREANOTEMPTY, segmented string area RESUME_LISTS is not empty, it
  may not be deleted
  ```
- An unexpected SSAREANOTEMPT error may be observed when trying to drop the table as shown in this example.

  ```
  SQL> set flags 'stomap_stats';
  SQL> drop table COMMENTS cascade;
  ~As: list partition BLOBS (1) is now empty
  %RDB-E-NO_META_UPDATE, metadata update failed
  -RDMS-E-SSAREANOTEMPTY, segmented string area BLOBS is not empty, it may not be
  deleted
  ```

  In some cases, this problem may be avoided by performing a DELETE prior to the DROP TABLE. However, if some orphan LIST segments exist for this table's logical areas then the DROP TABLE

may still fail.

```
SQL> set flags 'stomap_stats';
SQL> delete from COMMENTS;
4 rows deleted
SQL> drop table COMMENTS cascade;
~As: list partition BLOBS (1) is now empty
~As: list partition IMAGES (2) is now empty
```

- Unexpected storage extension when deleting LIST OF BYTE VARYING column data by assigning a NULL value and subsequent INSERT in the same transaction.
  In this case, Rdb should be reusing the deleted LIST segments rather than extending the storage area.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. The query code generated for assigning NULL to a LIST OF BYTE VARYING column now correctly erases the LIST column data.

5.1.2 Query With LIKE Clause Executes the Conjunct Twice

Bug 13813658

Some LIKE clauses with no prefix get incorrectly displayed as "Keys" in the index only retrieval node, as in the following example.

```
create index emp_last_desc on employees (last_name desc);
select last_name from employees where last_name like '%Z%';
Tables:
  0 = EMPLOYEES
Conjunct: 0.LAST_NAME LIKE '%Z%'    <= execute twice here???
Index only retrieval of relation 0:EMPLOYEES
  Index name  EMP_LAST_DESC [0:0]
    Keys: 0.LAST_NAME LIKE '%Z%'    <= execute once here
 LAST_NAME
 Ziemke
1 row selected
```

Since LIKE contains no prefix, it should not appear in the list of "Keys:" for index−only retrieval.

If the wildcard is removed, LIKE now contains the prefix "Z", and the conjunct should appear in the list of "Keys:" for index−only retrieval, but transformed to "STARTING WITH", as in the following example.

```
select last_name from employees where last_name like 'Z%';
Tables:
  0 = EMPLOYEES
Conjunct: 0.LAST_NAME STARTING WITH 'Z'
Index only retrieval of relation 0:EMPLOYEES
  Index name  EMP_LAST_DESC [1:1]
    Keys: 0.LAST_NAME STARTING WITH 'Z'
 LAST_NAME
 Ziemke
1 row selected
```

The problem occurs when the LIKE clause with no prefix is applied as index−only retrieval.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.1.3 Query With Zigzag Match Strategy Returns Wrong Result

Bug 13717173

The following customer's query, using zigzag match strategy, returns the wrong result (0 rows instead of 3 rows).

```
SELECT
    T3.COL1,
    T1.ADATE,
    T2.COL2,
    T2.COL3
FROM T3, T1, T2
WHERE
  T1.COL1        = T3.COL1
  AND T1.ADATE  >= 20120201
  AND T2.COL1    = T1.COL1
  AND T2.COL2    = T1.COL2
  and T1.COL2    = 123688
  AND T2.COL3    = T1.COL3;
~S: Outline "QO_BUG_MATCH_OL" used
Tables:
  0 = T3
  1 = T1
  2 = T2
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 2.COL1 = 1.COL1
    Conjunct: 2.COL2 = 1.COL2
    Conjunct: 2.COL3 = 1.COL3
    Match  Q1
      Outer loop      (zig-zag)
      Match_Keys:1.COL2, 1.COL1, 1.COL3
      Index_Keys:COL2, COL1, COL3
        Conjunct: 1.ADATE >= 20120201
        Conjunct: 1.COL2 = 123688
        Get     Retrieval by index of relation 1:T1
          Index name  T1_NDX_COL213 [0:0]
            Bool: 1.COL2 = 123688
      Inner loop      (zig-zag)
      Match_Keys:2.COL1, 2.COL2, 2.COL3
      Index_Keys:COL1, COL2, COL3, DATUM, OTHER_DATUM
        Conjunct: 2.COL2 = 123688
        Index only retrieval of relation 2:T2
          Index name  T2_NDX_COL123 [0:0]
  Cross block entry 2
    Index only retrieval of relation 0:T3
      Index name  T3_NDX [1:1]   Direct lookup
        Keys: 1.COL1 = 0.COL1
0 rows selected
```

The query works if the index T1_NDX_COL213 is dropped and the following index is added:

```
show index T1_NDX_COL123;
Indexes on table T1:
T1_NDX_COL123         with column A_SYSID_ACC_ANALYT
                      and column A_SYSID_DOC
```

```
                      and column A_SYSID_SYMBOL
  No Duplicates allowed
  Type is Sorted
  ...etc...
[... now execute the same query above ...]

~S: Outline "QO_MATCH_GOOD_OL" used
Tables:
  0 = T3
  1 = T1
  2 = T2
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 2.COL1 = 1.COL1
    Conjunct: 2.COL2 = 1.COL2
    Conjunct: 2.COL3 = 1.COL3
    Match  Q1
      Outer loop      (zig-zag)
      Match_Keys:1.COL1, 1.COL2, 1.COL3
      Index_Keys:COL1, COL2, COL3
        Conjunct: 1.ADATE >= 20120201
        Conjunct: 1.COL2 = 123688
        Get     Retrieval by index of relation 1:T1
          Index name  T1_NDX_COL123 [0:0]            <= new index added
            Bool: 1.COL2 = 123688
      Inner loop      (zig-zag)
      Match_Keys:2.COL1, 2.COL2, 2.COL3
      Index_Keys:COL1, COL2, COL3, DATUM, OTHER_DATUM
        Conjunct: 2.COL2 = 123688
        Index only retrieval of relation 2:T2
          Index name  T2_NDX_COL123 [0:0]
  Cross block entry 2
    Index only retrieval of relation 0:T3
      Index name  T3_NDX [1:1]   Direct lookup
        Keys: 1.COL1 = 0.COL1
    T3.COL1   T1.ADATE   T2.COL2   T2.COL3
    3426505   20120201    123688       607
  539541268   20120201    123688       606
 1611771726   20120201    123688       607
3 rows selected
```

The problem occurs when the query, in a zig−zag strategy, applies an outer index with different order of segments from the inner index, as in the following index.

```
      Outer loop      (zig-zag)
      Match_Keys:1.COL2, 1.COL1, 1.COL3
      Index_Keys:COL2, COL1, COL3                      <= See Note
        Get     Retrieval by index of relation 1:T1
          Index name  T1_NDX_COL213 [0:0]

        ...etc...

      Inner loop      (zig-zag)
      Match_Keys:2.COL1, 2.COL2, 2.COL3
      Index_Keys:COL1, COL2, COL3, DATUM, OTHER_DATUM <= See Note
        Index only retrieval of relation 2:T2
          Index name  T2_NDX_COL123 [0:0]
```

Note: The order of outer loop Index_Keys: "COL2, COL1, COL3" as compared to that of the inner loop Index_Keys:"COL1, COL2, COL3".

The Match_Keys for the Inner loop (zig−zag) is misleading here, indicating that all three keys are matched. In reality, the second segment "2.COL2" is the only key that is matched against the outer Match_Keys, since it is the leading segment of the outer Index_Keys.

Obviously, there is also a problem in the dumper output for zig−zag strategy where the Match_Keys are displayed incorrectly. The correct display should be as follows:

```
      Outer loop      (zig−zag)
      Match_Keys:1.COL2, 1.COL1, 1.COL3
      Index_Keys:COL2, COL1, COL3
        Get     Retrieval by index of relation 1:T1
          Index name  T1_NDX_COL213 [0:0]

        ...etc...

      Inner loop      (zig−zag)
      Match_Keys:2.COL2                    <== See Note
      Index_Keys:COL1, COL2, COL3, DATUM, OTHER_DATUM
        Index only retrieval of relation 2:T2
          Index name  T2_NDX_COL123 [0:0]
```

Note: "2.COL2" is the only Match_Key that should be displayed in the Inner Loop (zig−zag) block.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.1.4 Zig−zag Query With Mapping Values Index Returns Wrong Result

Bug 9922531

In prior releases of Oracle Rdb, it was possible to get wrong results when the zig−zag match strategy was selected. This is shown by the following query.

```
SQL> select t2.f4
cont> from t1 join t2
cont> on  t2.f1 = t1.f1 and t2.f2 = t1.f2 and t2.f3 = t1.f3
cont> where
cont>    t1.f4 = 'xyz' and
cont>    t1.f2 in (1,3,5)
cont> optimize using OL_MATCH;
~S: Outline "OL_MATCH" used
Tables:
  0 = T1
  1 = T2
Conjunct: (1.F1 = 0.F1) AND (1.F2 = 0.F2) AND (1.F3 = 0.F3)
Match  Q1
  Outer loop      (zig−zag)
  Match_Keys:1.F1, 1.F2, 1.F3
  Index_Keys:F1, F2, F3
    Conjunct: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
    Get     Retrieval by index of relation 1:T2
      Index name  I2 [0:0]
        Bool: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
  Inner loop      (zig−zag)
  Match_Keys:0.F1, 0.F2, 0.F3
  Index_Keys:F1, F2, F3, F4
```

```
    Conjunct: 0.F4 = 'xyz'
    Conjunct: (0.F2 = 1) OR (0.F2 = 3) OR (0.F2 = 5)
    Index only retrieval of relation 0:T1
      Index name  I1 [0:0]
        Bool: (0.F4 = 'xyz') AND ((0.F2 = 1) OR (0.F2 = 3) OR (0.F2 = 5))
 T2.F4
 xyz
1 row selected
```

However the query works if the cross strategy is used, as in the following example.

```
SQL> select t2.f4
cont> from t1 join t2
cont> on  t2.f1 = t1.f1 and t2.f2 = t1.f2 and t2.f3 = t1.f3
cont> where
cont>     t1.f4 = 'xyz' and
cont>     t1.f2 in (1,3,5)
cont> optimize using OL_CROSS;
~S: Outline "OL_CROSS" used
Tables:
  0 = T1
  1 = T2
Cross block of 2 entries  Q1
  Cross block entry 1
    Leaf#01 FFirst 1:T2 Card=8
      Bool: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
      BgrNdx1 I2 [0:0] Fan=11
        Bool: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
  Cross block entry 2
    Conjunct: (0.F2 = 1) OR (0.F2 = 3) OR (0.F2 = 5)
    Index only retrieval of relation 0:T1
      Index name  I1 [4:4]
        Keys: (1.F1 = 0.F1) AND (1.F2 = 0.F2) AND (1.F3 = 0.F3) AND (0.F4 =
              'xyz')
 T2.F4
 xyz
 xyz
2 rows selected
```

The query works if the zig−zag is disabled at the outer loop, as in the following example.

```
SQL> set flags 'nozigzag_outer';
SQL>
SQL> select t2.f4
cont> from
cont>     t1 join t2
cont> on  t2.f1 = t1.f1 and t2.f2 = t1.f2 and t2.f3 = t1.f3
cont> where
cont>     t1.f4 = 'xyz' and
cont>     t1.f2 in (1,3,5)
cont> optimize using OL_MATCH;
~S: Outline "OL_MATCH" used
Tables:
  0 = T1
  1 = T2
Conjunct: (1.F1 = 0.F1) AND (1.F2 = 0.F2) AND (1.F3 = 0.F3)
Match  Q1
  Outer loop
  Match_Keys:1.F1, 1.F2, 1.F3
    Conjunct: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
    Get     Retrieval by index of relation 1:T2
```

```
      Index name  I2 [0:0]
        Bool: (1.F2 = 1) OR (1.F2 = 3) OR (1.F2 = 5)
  Inner loop      (zig-zag)
  Match_Keys:0.F1, 0.F2, 0.F3
  Index_Keys:F1, F2, F3, F4
    Conjunct: 0.F4 = 'xyz'
    Conjunct: (0.F2 = 1) OR (0.F2 = 3) OR (0.F2 = 5)
    Index only retrieval of relation 0:T1
      Index name  I1 [0:0]
        Bool: (0.F4 = 'xyz') AND ((0.F2 = 1) OR (0.F2 = 3) OR (0.F2 = 5))
 T2.F4
 xyz
 xyz
2 rows selected
```

The query also works if the mapped values in the index I1 are removed.

```
SQL> show index I1;
Indexes on table T1:
I1                              with column F1
                                and column F2
                                mapping values 0 to 32767
                                and column F3
                                mapping values 0 to 32767
                                and column F4
  Duplicates are allowed
  Type is Sorted Ranked
    Duplicates are Compressed Bitmaps
  Key suffix compression is DISABLED
  Node size 430

SQL> drop index I1;
SQL> create index I1
cont>     on T1
cont>         (f1
cont>         ,f2
cont>         ,f3
cont>         ,f4)
cont>     type is SORTED RANKED;
```

The problem occurs when the query, in a zig−zag strategy, uses an index defined with MAPPING VALUES.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.1.5 Query Bugchecks With MAX, MIN or COUNT

Bug 5245269

When the dialect is set to enable NULL elimination warnings, the select query with either MAX, MIN or COUNT using partitioned index may bugcheck.

The following is the reproducer for the above problem:

```
$ SQL$
SQL> attach 'filename PERSONNEL2';
SQL> set flags 'strategy,detail(2)';

SQL> create index MI_INDEX
```

```
cont>     on EMPLOYEES (MIDDLE_INITIAL)
cont>     type is SORTED RANKED
cont>     store using (MIDDLE_INITIAL)
cont>         in AREA_20 with limit of ('F')
cont>         in AREA_21 with limit of ('Z')
cont>         otherwise in AREA_22
cont> ;
SQL>
SQL> select max(middle_initial) from employees;
Tables:
  0 = EMPLOYEES
Aggregate: 0:MAX (0.MIDDLE_INITIAL) Q2
Index only retrieval of relation 0:EMPLOYEES
  Index name  MI_INDEX [0:0]     Max key lookup
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USD04:[ONG]RDSBUGCHK.DMP;
```

The query works without the partitioned index defined, as in the following example.

```
SQL> drop index MI_INDEX;
SQL> select max(middle_initial) from employees;
Tables:
  0 = EMPLOYEES
Aggregate: 0:MAX (0.MIDDLE_INITIAL) Q2
Get     Retrieval sequentially of relation 0:EMPLOYEES

 Z
1 row selected
%RDB-I-ELIM_NULL, null value eliminated in set function
```

The key parts of this query which contributed to the situation leading to the error are these:

1. The SQL dialect is set to SQL92, SQL99, ORACLE LEVEL1, or ORACLE LEVEL2.
2. The index is partitioned.
3. The function is either MAX (where the "Max key lookup" strategy is employed), MIN (where the "Min key lookup" strategy is employed) or COUNT (where the "Index counts lookup" or "Index distinct lookup" strategy is employed).

This problem has been corrected in Oracle Rdb Release 7.2.5.2. These strategies ("Max key lookup", "Min key lookup", "Index counts lookup", "Index distinct lookup") do not return the correct warning for null elimination. These strategies are disabled in this release when null semantics are required.

5.1.6 Query Bugchecks When the Index is Partitioned With Descending Segment

Bug 14231913

The following is the reproducer for the above problem:

```
$ SQL$
create database
    filename PERSONNEL2

    create storage area AREA_20
        page format is UNIFORM
    create storage area AREA_21
        page format is UNIFORM
```

```
    create storage area AREA_22
        page format is UNIFORM
;

create table EMPLOYEES (
    MIDDLE_INITIAL
        CHAR (1)
    );
create storage map EMPLOYEES_MAP
    for EMPLOYEES
    store in AREA_21 ;

create index MI_INDEX
    on EMPLOYEES (MIDDLE_INITIAL desc)
    type is SORTED RANKED
    store using (MIDDLE_INITIAL)
        in AREA_21 with limit of ('Z')
        in AREA_20 with limit of ('F')
        otherwise in AREA_22 ;
commit;

select middle_initial from employees
where middle_initial >= 'R' and middle_initial is NOT null;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file DEV:[DIR]RDSBUGCHK.DMP;
```

The following similar query works using the "less than" operator, as in the following example.

```
select middle_initial from employees
where middle_initial < 'R' and middle_initial is NOT null;
Tables:
  0 = EMPLOYEES
Conjunct: NOT MISSING (0.MIDDLE_INITIAL)
Index only retrieval of relation 0:EMPLOYEES
  Index name  MI_INDEX [1:0]
    Keys: 0.MIDDLE_INITIAL < 'R'
0 rows selected
```

The problem occurs when the index is partitioned with a descending segment.

The key parts of this query which contributed to the situation leading to the error are these:

1. The index is partitioned.
2. The segment is descending.
3. One of the WHERE clauses uses a "greater than or equal" or "greater than" operator, and the other is a NOT Null.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.2 SQL Errors Fixed

5.2.1 Unexpected SQL−F−PARSE_STACK_OVE Error On Repeated CREATE VIEW Statements

Bug 13773153

In prior versions of Oracle Rdb, SQL might fail with a SQL−F−PARSE_STACK_OVE error if view definitions from RMU Extract were executed.

The following example shows a view containing COUNT and DISTINCT of a value expression.

```
SQL> create view TEST (A_ID, A_FLAG)
cont>     as select A_ID,
cont>     case
cont>          when (select count(distinct H.A_DATE)
cont>           from HISTORY H
cont>           where H.A_ID = M.A_ID)
cont>           >= 2 then 'Y'
cont>          else 'N'
cont>     end
cont>     from MARGIN M;
SQL>
```

The SQL semantics for COUNT (DISTINCT) is to ignore all NULL value results for that expression. Therefore, an implicit IS NOT NULL clause is added to the WHERE clause to enforce these semantics. RMU Extract includes this implicit clause when extracting the view since that tool does not know if the clause was added as part the users CREATE VIEW definition or implicitly by SQL. Notice the clause "C2.A_DATE is not null" in the output shown below for this same VIEW deifnition.

```
$ rmu/extract/item=view/option=(filename_only,noheader) abc
set verify;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 001, TIME 001;
attach 'filename ABC';
create view TEST
    (A_ID,
     A_FLAG) as
    (select
        C1.A_ID,
        case
             when ((select count(distinct C2.A_DATE)
                from HISTORY C2
                where ((C2.A_ID = C1.A_ID)
                    and (C2.A_DATE is not null))) >= 2) then 'Y'
             else 'N'
        end
    from MARGIN C1);

commit work;
```

Repeated RMU Extracts of the view and use of the extracted definition to replace the previous version resulted in a long sequence of "C2.A_DATE is not null" clauses in the query. Eventually this could lead to errors during CREATE VIEW, such as "%SQL−F−PARSE_STACK_OVE, Parse stack overflow".

This problem has been corrected in Oracle Rdb Release 7.2.5.2. This release of Oracle Rdb will detect that the semantic check IS NOT NULL for the value expression is already present in the query definition (WHERE clause or aggregate FILTER clause) and no longer continue to add further "C2.A_DATE is not null" clauses.

5.2.2 Unexpected ARITH_EXCEPT When Using STDDEV Aggregate Function

Bug 13741723

For some data sets, the VARIANCE function or STDDEV could produce an incorrect result, or in some cases raise an exception as shown in the example below.

```
SQL> select variance(t), stddev (t)
cont> from (
cont>     select 118733.89 from rdb$database union all
cont>     select 118701.17 from rdb$database union all
cont>     select 118666.94 from rdb$database) as aa (t);
%RDB−E−ARITH_EXCEPT, truncation of a numeric value at runtime
−SYSTEM−F−FLTINV, floating invalid operation, PC=FFFFFFFF82061BA2, PS=0000000B
SQL>
```

This problem shows a flaw in the algorithm used to compute the VARIANCE, from which the STDDEV (standard deviation) is computed. When the sum of the squares of the values is a similar number to the sum multiplied by the mean, it is possible that the round errors inherent in floating point arithmetic will cause such errors.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. Oracle Rdb has replaced the old algorithm with one that is more stable in these circumstances.

5.2.3 Unexpected Bugcheck When REVOKE Used on a Table With an IDENTITY Column

Bug 13841632

In Oracle Rdb Release 7.2.5.1, a change was made to propagate the ACL of the table to the owned IDENTITY column. Since that change was made, it is possible to receive an unexpected bugcheck. This is shown in the example blow.

```
SQL> revoke ALL on table T1 from PUBLIC after USER3;
%RDMS−I−BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
SQL>
```

This problem occurs because only a subset of the ACE entries of the table are copied to the ACL for the IDENTITY sequence. The bugcheck occurs trying to issue the error ACENOTFND (no matching access control entry found) and should have been reported by Rdb as:

```
SQL> revoke ALL on table T1 from PUBLIC after RDBUSER3;
```

```
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-E-ACENOTFND, no matching access control entry found
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2. Oracle Rdb now propagates all ACEs, not just those that allow INSERT on the table. This allows correct behavior for the GRANT and REVOKE statements on tables with an IDENTITY column.

5.2.4 Unexpected RDB-E-NOT_VALID Error From ALTER TABLE ... ADD COLUMN

Bug 13790454

In prior releases of Oracle Rdb, it was possible that ALTER TABLE ... ADD COLUMN with a domain constraint could fail even though the existing data in the table did not violate the domain definition.

Consider the case where a domain constraint is added with a new column that has no DEFAULT or an explicit DEFAULT of NULL. When the table has existing rows, Rdb partially evaluates the constraint assuming the column is NULL (this is an attempt to minimize the I/O). Any other DEFAULT expression causes the rows of the table to be read and the domain constraint evaluated for each row.

However, this partial evaluation is incomplete in handling UNKNOWN conditions. The RDO and CDD interfaces define different semantics for the treatment of UNKNOWN conditions from the SQL standard and the current partial evaluation only supports RDO and CDD semantics but does not fully support the SQL standard.

As defined in the ANSI and ISO SQL Standard: *A domain constraint is satisfied by SQL-data if and only if, for every table T that has a column named C based on that domain, the applicable <search condition> recorded in the appropriate domain constraint usage evaluates to True or Unknown.*

The following example shows the discrepancy between domain constraint evaluation during ALTER TABLE when data exists in the table and INSERT into an empty table.

```
SQL> create domain UNSIGNED_INTEGER
cont>     integer
cont>     check (value >= 0)
cont>     not deferrable;
SQL>
SQL> create table SAMPLE_TABLE
cont>     (C UNSIGNED_INTEGER
cont>     );
SQL>
SQL> insert into SAMPLE_TABLE default values;
1 row inserted
SQL> insert into SAMPLE_TABLE values (100);
1 row inserted
SQL> -- expected failure
SQL> insert into SAMPLE_TABLE values (-1);
%RDB-E-NOT_VALID, validation on field C caused operation to fail
SQL>
SQL> -- unexpected failure on implicit NULL default for new column
SQL> alter table SAMPLE_TABLE
cont>     add column D UNSIGNED_INTEGER;
%RDB-E-NO_META_UPDATE, metadata update failed
```

```
-RDB-E-NOT_VALID, validation on field D caused operation to fail
-RDMS-F-MISSINGINV, existing records in relation SAMPLE_TABLE would violate
VALID IF expression
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

Note that external and SQL functions will now be evaluated by ALTER TABLE ... ADD COLUMN in this release but were not in previous releases when the default was omitted or was explicitly NULL. If these functions have side effects, then the database administrator should manage them accordingly.

5.2.5 Unexpected Partition Chosen When Malformed Storage Map Created

Bug 3867875

In prior releases of Oracle Rdb, the ordering of the WITH LIMIT values in the storage map were not validated. This could allow the creation of malformed storage maps that did not correctly partition the inserted values.

The following example shows that the incorrectly ordered limits cause the row with FLD1 of 500 to be inserted in an unexpected partition.

```
SQL> create table tst_table (
cont>   fld1          integer,
cont>   ttxt          char(5)
cont> );
SQL>
SQL> create storage map tst_map for tst_table
cont>    partitioning is not updatable
cont>    store using (fld1)
cont>     in TST_AREA1 with limit of (200)
cont>     in TST_AREA2 with limit of (300)
cont>     in TST_AREA3 with limit of (600)
cont>     in TST_AREA4 with limit of (450)
cont>     in TST_AREA5 with limit of (750)
cont> ;
SQL>
SQL> insert into tst_table values (150,'bbbbb') returning dbkey;
                 DBKEY
                64:2:1
1 row inserted
SQL> insert into tst_table values (250,'ccccc') returning dbkey;
                 DBKEY
                65:2:1
1 row inserted
SQL> insert into tst_table values (440,'ddddd') returning dbkey;
                 DBKEY
                66:2:1
1 row inserted
SQL> insert into tst_table values (500,'aaaaa') returning dbkey;
                 DBKEY
                66:2:2
1 row inserted
SQL> insert into tst_table values (700,'ddddd') returning dbkey;
                 DBKEY
                68:2:1
```

```
1 row inserted
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2. Oracle Rdb now validates the partition values from an ascending set of distinct partitions. This example shows the new correct diagnostics.

```
SQL> create storage map tst_map for tst_table
cont>    partitioning is not updatable
cont>    store using (fld1)
cont>     in TST_AREA2 with limit of (200)
cont>     in TST_AREA3 with limit of (300)
cont>     in TST_AREA1 with limit of (600)
cont>     in TST_AREA4 with limit of (450)
cont>     in TST_AREA5 with limit of (750)
cont> ;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-F-MAPNOTDEF, map "TST_MAP" has not been defined
-RDMS-E-MAPLIMITORDBAD, partition 4 limits are not in order for partitioned
table TST_MAP
SQL>
```

5.2.6 Workload and Storage Statistics Not Cleared by TRUNCATE TABLE

Bugs 8741822 and 8741757

In prior versions of Oracle Rdb, neither the storage nor the workload statistics were cleared when a TRUNCATE TABLE statement was executed. This could lead to poor strategy selection by the optimizer which was using the old (stale) statistics.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. TRUNCATE TABLE now explicitly clears the Rdb$Workload rows associated with the table, as well as removing any index or table storage statistics.

5.3 RDO and RDML Errors Fixed

5.3.1 GET DIAGNOSTICS Did Not Return a Valid IMAGE_NAME in Some Cases

Bug 14161648

In prior versions of Oracle Rdb, the data used for the GET DIAGNOSTICS IMAGE_NAME item were not provided for all images. In particular, applications written with an RDML module that performed the attach to the database would have spaces returned for the image name.

This can be observed by using the logical name RDMS$SET_FLAGS to display the database parameter buffer during attach to the database. It is the IMAGE_NAME parameter value that is used for the GET DIAGNOSTICS statement, or the SYS_GET_DIAGNOSTICS function. Notice that there is no "Database Parameter Buffer" displayed.

```
$ define rdms$set_flags database
$ run test_image
 ATTACH #1, Database DISK1:[TESTING]PERSONNEL.RDB;1
 RDMS$BIND_WORK_FILE = "DISK1:[TESTING]RDMSTTBL$PBKLMDHG71B1GJLVKN80.TMP;"
(Visible = 0)
 DETACH #1
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2. The Rdb/Dispatch layer has been corrected to provide the image name in all cases. Note that applications running under older Rdb versions in a multiversion environment may also notice a change in behavior because the Rdb/Dispatch image is used for all versions.

The following example shows the expected output.

```
$ define rdms$set_flags database
$ run test_image
 ATTACH #1, Database DISK1:[TESTING]PERSONNEL.RDB;1
~P Database Parameter Buffer (version=2, len=44)
0000 (00000) RDB$K_DPB_VERSION2
0001 (00001) RDB$K_FACILITY_ALL
0002 (00002) RDB$K_DPB2_IMAGE_NAME "MYNODE::DISK1:[TESTING]TEST_IMAGE.EXE;1"
 RDMS$BIND_WORK_FILE = "DISK1:[TESTING]RDMSTTBL$FVS6UTIG71B1GJLVKN80.TMP;"
(Visible = 0)
 DETACH #1
$
```

5.4 RMU Errors Fixed

5.4.1 RMU/BACKUP/PLAN Displays Too Vague Message When RMU_SERVICE Is Not Running

Bug 13640704

In releases prior to Oracle Rdb 7.2.5.2, the Oracle Rdb RMU/BACKUP/PLAN command displayed the generic RMU−F−UNRECDBSERR error if the SQL/Services RMU_SERVICE service was not running. This message is generic and does not help diagnose the problem. The RMU/EXECUTE/COMMAND command displays the more specific SQLSRV−E−SVCNOTRUN error in the same situation.

For example, in prior releases, the RMU/BACKUP/PLAN command displayed the RMU−F−UNRECDBSERR, as shown below.

```
$ RMU/BACKUP/PLAN MF_PERS.PLAN
%RMU−F−ERREXCCMD, Error executing command "rmu/backup/plan
$1$DGA15:[PERSONNEL]MF_PERS.PLAN;"
−RMU−F−UNRECDBSERR, Network error: Unrecognized DBS error.
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 30−JAN−2012 09:55:32.72
```

The more descriptive RMU−E−SVCNOTRUN error message is now displayed.

```
$ RMU/BACKUP/PLAN MF_PERS.PLAN
%RMU−F−ERREXCCMD, Error executing command "rmu/backup/plan
$1$DGA15:[PERSONNEL]MF_PERS.PLAN;"
−RMU−E−SVCNOTRUN, Network error: RMU_SERVICE service is not running.
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 30−JAN−2012 09:55:32.72
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2. RMU now displays the more descriptive RMU−E−SVCNOTRUN message.

5.4.2 RMU/RECOVER/ORDER_AIJ_FILES Error Handling Problem When Ordering Files

Bug 13608020

There was an error handling problem if an error occurred when RMU/RECOVER/ORDER_AIJ_FILES was sorting the input AIJ files in ascending order by sequence number. An access violation occurred in the error handler followed by a loop producing multiple access violations which produced multiple RMUBUGCHK.DMP files. A "CTRL/Y" had to be executed to terminate the loop. This problem has now been fixed.

The following example shows the problem. An error exception occurs when RMU/RECOVER is sorting the input AIJ files in ascending order by sequence number at the start of the recovery operation because one of the AIJ files is locked by another user. The error handler for this error exception gets into a loop which produces multiple "%SYSTEM−F−ACCVIO" errors and multiple RMUBUGCHK.DMP files. This loop can only be terminated by a "CTRL/Y".

```
$ RMU/RECOVER AIJB* /ORDER_AIJ_FILES/NOLOG
%RMU-F-FILACCERR, error reading journal file
DEVICE:[DIRECTORY]AIJB_4.AIJ;1
-RMS-E-FLK, file currently locked by another user
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:37:29.91
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=000000000000018C, PC=000000008078F4A1, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file
DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:37:30.03
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=000000000000018C, PC=000000008078F4A1, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file
DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:37:30.11
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=000000000000018C, PC=000000008078F4A1, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file
DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:37:30.19
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=000000000000018C, PC=000000008078F4A1, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file
DEVICE:[DIRECTORY]RMUBUGCHK.DMP_MINI;
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:37:30.25
```

The following example shows that this problem has been fixed. Now when the AIJ file to be sorted is locked by another user, the error exception is handled correctly. The fatal error is output and the recovery is aborted.

```
$ RMU/RECOVER AIJB* /ORDER_AIJ_FILES/NOLOG
%RMU-F-FILACCERR, error reading journal file
DEVICE:[DIRECTORY]AIJB_4.AIJ;1
-RMS-E-FLK, file currently locked by another user
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 13-FEB-2012 13:40:40.26
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.3 RMU/BACKUP/PARALLEL Deadlock and Bugcheck With Access Violation

Bugs 13635595 and 4615389

In releases prior to Oracle Rdb Release 7.2.5.2, there was a problem in RMU/BACKUP/PARALLEL where worker executors would sometimes deadlock against one another when fast incremental backup was enabled. Then, an access violation occurred while processing the deadlock error and resulted in RMU and Oracle SQL/Services executor bugchecks. Therefore, what the user saw was bugchecks showing an access violation.

The following would be seen in the RMU bugcheck file.

```
SYSTEM-F-ACCVIO, access violation, virtual address=0000000000000000
Exception occurred at RMUSHR72\BACKUP_READ_ROOT + 000079A1
```

The following would be seen in the SQL/Services executor bugcheck file.

```
DBS-F-BUGCHECK in RMUEXEC at line 477
Internal error: unhandled exception or signalled condition '%CMA-F-EXCCOP,
exception raised; VMS condition code follows, -SYSTEM-F-ACCVIO, access
violation, reason mask=00, virtual address=0000000000000001,
PC=000000000094A111, PS=0000001B'
```

The deadlock error was only displayed if the logical RMU$DEBUG_FLAGS was defined as RMU_DEBUG_ALL.

```
WORKER_001: %RMU-F-DEADLOCK, deadlock on Fast-Incremental-Backup
WORKER_001: %RMU-F-FTL_RMU, Fatal error for RMU operation at 23-JAN-2012
09:39:10.79
```

Both problems have been corrected in Oracle Rdb Release 7.2.5.2. RMU/BACKUP/PARALLEL worker executors will no longer deadlock and error handling has been corrected so that it will not cause access violations and bugchecks.

5.4.4 RMU/BACKUP/PARALLEL Plan Name Length Parsing Errors

Bug 13836182

The Oracle Rdb RMU parallel backup command creates the plan name entry in the parallel backup plan file ("Plan Name = ") to be the same as the plan file name specified by the /LIST_PLAN qualifier on the parallel backup command line. However, there was a problem where Rdb enforced a maximum file name length of 39 characters for the plan file name based on the VMS ODS-2 specification, but when RMU read and parsed the plan file, it enforced a maximum length of 31 characters for the plan name entry. Therefore, the plan name entry in the plan file created by RMU could have a length of up to 39 characters but when RMU read and parsed the plan file to execute the parallel backup, it would output a syntax error if the plan name length exceeded 31 charcters.

A related problem was that if the user specified /EXECUTE for immediate execution of the parallel backup on the parallel backup command line and did not specify "/LIST_PLAN=planfile_name", a unique plan name was generated that was 32 characters long, so a syntax error always occurred in this case when the temporary plan file was read and parsed by RMU before the temporary plan file was executed and then deleted.

The way to avoid these problems is to always use the /LIST_PLAN qualifier to specify a plan file name no longer than 31 characters. Also, if a plan file has been created which has a "Plan Name = " entry longer than 31 characters, the plan file can be edited to reduce the plan file name to 31 characters and then the RMU/BACKUP/PLAN command can be used to execute the edited plan file.

These problems have been fixed and now the plan file name maximum length and the plan name maximum length are both set to 39 characters.

The following two examples show the problem. In the first parallel backup command, the /LIST_PLAN qualifier is not used to name the plan file so a default temporary plan file with a generated unique file name is created, executed and then deleted. However, the plan name derived from the plan file name in the plan file is 32 characters long and a parsing error is returned since the incorrect parsing logic only allows a plan name length of 31 characters. In the second example, the same problem occurs because even though the

/LIST_PLAN qualifier is used to specify the plan file name, the plan file name specified is also 32 characters long and the incorrect parsing logic only allows a plan name length of 31 characters.

```
$ rmu/backup −
    /parallel=executor=3 −
    /disk_file −
    /nolog −
    /execute −
    /checksum_verification −
    /active_io=5 −
    /page_buffers=5 −
    /crc=checksum −
    /noquiet_point −
 mf_personnel −
  [.dir1]parallel_backup.rbf −
 ,[.dir2] −
 ,[.dir3]
%RMU−F−PLNSYNTAX, Syntax error in plan file
        PLAN NAME = 'BACKUP_PLAN_CSB45CBQ4VA1GD3N3E80'
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 13−MAR−2012 18:52:04.35
$
$ rmu/backup −
    /parallel=executor=3 −
    /disk_file −
    /nolog −
    /execute −
    /checksum_verification −
    /active_io=5 −
    /page_buffers=5 −
    /crc=checksum −
    /noquiet_point −
    /list_plan = BACKUP_PLAN_NAME_LONGER_THAN_31C.PLAN −
 mf_personnel −
  [.dir1]parallel_backup.rbf −
 ,[.dir2] −
 ,[.dir3]
%RMU−F−PLNSYNTAX, Syntax error in plan file
        PLAN NAME = 'BACKUP_PLAN_NAME_LONGER_THAN_31C'.
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 13−MAR−2012 19:53:07.21
$
```

The following example shows that this problem has been fixed. The same two parallel backup commands are used, but both commands succeed because the plan file parsing logic has been corrected to allow up to 39 characters for the plan file name.

```
$ rmu/backup −
    /parallel=executor=3 −
    /disk_file −
    /nolog −
    /execute −
    /checksum_verification −
    /active_io=5 −
    /page_buffers=5 −
    /crc=checksum −
    /noquiet_point −
 mf_personnel −
  [.dir1]parallel_backup.rbf −
 ,[.dir2] −
 ,[.dir3]
%RMU−I−COMPLETED, BACKUP operation completed at 14−MAR−2012 18:04:32.53
```

```
$ show symbol $status
  $STATUS == "%X10000001"
$
$ rmu/backup −
    /parallel=executor=3 −
    /disk_file −
    /nolog −
    /execute −
    /checksum_verification −
    /active_io=5 −
    /page_buffers=5 −
    /crc=checksum −
    /noquiet_point −
    /list_plan = BACKUP_PLAN_NAME_LONGER_THAN_31C.PLAN −
 mf_personnel −
  [.dir1]parallel_backup.rbf −
 ,[.dir2] −
 ,[.dir3]
%RMU−I−COMPLETED, BACKUP operation completed at 14−MAR−2012 19:21:15.47
$ show symbol $status
  $STATUS == "%X10000001"
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.5 Unexpected Bugcheck When Using RMU Collect Optimizer_Statistics

Bugs 9584258 and 12928341

In prior releases of Oracle Rdb, the RMU Collect Optimizer_Statistics might, in rare cases, bugcheck during processing of a table. The cause was highly dependent on the data in the table. The bugcheck footprint would have been similar to the following:

Bugcheck dump summarizer output:

- Itanium OpenVMS 8.3−1H1
- Oracle Rdb Server 7.2.4.0.0
- Got a RMUBUGCHK.DMP
- SYSTEM−F−ACCVIO, access violation, virtual address=00000000054E56F6
- Exception occurred at RMU72\RMUCOL_CALC_WORKLOAD_STATS + 00005BE1
- Called from RMU72\RMUCOL_CALC_WORKLOAD_STATS + 000004B0
- Called from RMU72\RMU$COLLECT_CONVERT + 00017B40
- Called from RMU72\RMUCLI$COLLECT + 00000260
- Running image RMU72.EXE
- Command line was: RMUI/COLLECT OPTIMIZER/TABLE=tablename/TRANSACTION=READ/LOG databasename

This problem was corrected in Oracle Rdb Release 7.2.5.

5.4.6 Unexpected RECDEFSYN From RMU Unload

Bug 4260669

In prior releases of Oracle Rdb, RMU Load would fail when the Record Definition file contained names with spaces or were in special character sets such as DEC_KANJI.

The following example shows that RMU Load fails with a RECDEFSYN error when the name contains unexpected characters (in this case space characters).

```
$ rmu/unload abc "all lower case" n/record=file=nws
%RMU-I-DATRECUNL,   1 data records unloaded  3-APR-2012 14:49:26.63.
$ rmu/load abc "all lower case" n/record=file=nws
  DEFINE FIELD a column DATATYPE IS SIGNED LONGWORD.
%RMU-F-RECDEFSYN, Syntax error in record definition file
    'DEFINE' FIELD A COLUMN DATATYPE IS SIGNED LONGWORD.
%RMU-I-DATRECSTO,   0 data records stored  3-APR-2012 14:49:26.73.
%RMU-F-FTL_LOAD, Fatal error for LOAD operation at  3-APR-2012 14:49:26.73
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2. RMU Unload will now generate delimited identifiers for any names not in uppercase ASCII. RMU Load now correctly handles delimited identifiers.

5.4.7 Unexpected Reset of RECORD LENGTH in AIP After RMU Repair Initialize=TSN Command

Bug 13975847

In prior versions of Oracle Rdb, the RMU Repair Initialize=TSN command would incorrectly set the record length in the AIP (area inventory pages) to zero. The subsequent rebuild of the SPAM pages would compute inaccurate THRESHOLDS for UNIFORM logical areas and mark the fullness to threshold zero.

The impact of this would be reduced performance because the SPAM thresholds were no longer a good indication of free space on the page.

A workaround for the affected databases was to restore the record length using the RMU/SET AIP/LENGTH and then rebuild the SPAM pages using RMU/SET AIP /REBUILD. These commands can be performed online if necessary.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.8 RMU/REPAIR/INITIALIZE=TSN Fails With SYSTEM-F-ACCVIO and Bugchecks

Bug 13964771

In prior versions of Oracle Rdb, it was possible for the RMU/REPAIR/INIT=TSN command to generate an access violation and bugcheck with a footprint similar to the following:

```
Alpha OpenVMS 8.2
Oracle Rdb Server 7.2.5.1.1
Got a RMUBUGCHK.DMP
SYSTEM-F-ACCVIO, access violation, virtual address=0000000000B26001
Exception occurred at RMU72\RMUFIX$INIT_ONE_STAREA + 00000764
Called from RMU72\RMUCLI$REPAIR + 0000174C
Called from RMU72\RMU_DISPATCH + 00000E64
```

```
Called from RMU72\RMU_STARTUP + 000004DC
Running image RMU72.EXE
Command line was: RMUI/REPAIR/INIT=TSN
```

This problem does not happen to all databases on which the RMU/REPAIR/INIT=TSN is executed. Additionally, it could only occur on mixed storage areas.

It is difficult to predict which databases could be affected, as it is related to a combination of factors including the size of spam page intervals, and the size of the data page. It is more likely to occur when spam intervals are not evenly divisible by the size of the buffers (65536 bytes / bytes per data page) into which we read the data pages.

There is no workaround for this problem. Oracle recommends upgrading to this release prior to running the RMU/REPAIR/INIT=TSN command.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.9 New Details for Space Management Output From RMU Dump Header

Bug 14030557

The number of SPAM pages in a UNIFORM area is limited by the size of the bitvector managed by the ABM (area bitmap pages). Only one clump of ABM pages is allocated for each logical area and the clump size is computed based on the number of pages (PAGE SIZE) that can fit into a database buffer (BUFFER SIZE). For example, a default database created with BUFFER SIZE IS 6 BLOCKS and PAGE SIZE IS 2 BLOCKS will default to a clump size of 3 pages for those logical areas mapped to the uniform physical area.

RMU Dump Header has been enhanced to display the clump page count for uniform areas, and to also compute the upper limit of usable SPAM pages in that physical area.

The following example shows the modified "Space Management" section of RMU/DUMP/HEADER.

```
Space Management...
  - SPAMS are enabled
  - Interval is 1089 data pages
  - Current SPAM page count is 2
  - Clump page count is 3
  - Maximum usable SPAM page count is 23328
```

Note that "Clump page count" and "Maximum usable SPAM page count" are only displayed for UNIFORM page format areas.

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.10 New Option POSITION_COLUMN Added to RMU Extract

Bug 14085671

In prior versions of Oracle Rdb, tables that were altered to reorder columns using BEFORE COLUMN and AFTER COLUMN clauses were extracted as a CREATE TABLE statement followed by an ALTER TABLE statement. This is done by RMU Extract to ensure that dependencies between columns (COMPUTED BY, AUTOMATIC AS and DEFAULT clauses) are maintained if possible.

The following example shows the output for a simple table.

```
create table TEST_TABLE (
    FLD1
        CHAR (10),
    FLD2
        CHAR (10),
    FLD3
        CHAR (10));

    -- apply the alternate column ordering
    alter table TEST_TABLE
        alter column FLD3 before column FLD1;
```

In some cases, the user may wish to have only a CREATE TABLE statement. Therefore, this release of RMU Extract supports a new Option, POSITION_COLUMN, which will order columns by position instead of the default field identification. Note that such definitions may not be able to create the table if referenced columns appear after their reference. The default option is NOPOSITION_COLUMN.

This change has been made in Oracle Rdb Release 7.2.5.2.

5.4.11 RMU/VERIFY/LAREA Access Violation if Invalid Logical Area Id Specified

If the /LAREA qualifier, when used with the RMU/VERIFY command to verify specific logical areas for an Oracle Rdb database, specified an invalid logical area id number which did not exist in the target database, an access violation occurred and the verify operation was aborted with a fatal error.

This problem has been fixed and now, instead of an access violation, error messages identifying the problem and specifying the valid logical area id range for the target database will be output before the verify is aborted.

The following example shows the problem. The logical area id numeric values "0" and then "65888525" specified with the /LAREA qualifier do not exist in the Oracle Rdb database being verified. This causes an access violation, the creation of an RMUBUGCHK.DMP file and a termination of the verify operation.

```
$ RMU/VERIFY/NOLOG/LAREA=0 MF_PERSONNEL
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
 virtual address=000000000000001D, PC=00000000806A8D80, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_VER, Fatal error for VERIFY operation at  1-JUN-2012 14:31:02.58
$ RMU/VERIFY/NOLOG/LAREA=65888525 MF_PERSONNEL
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
 virtual address=00000000202ACDF4, PC=00000000806A8D50, PS=0000001B
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FTL_VER, Fatal error for VERIFY operation at  1-JUN-2012 14:31:29.40
```

The following example shows that this problem has been fixed. Now the same invalid logical area id numbers specified with the RMU/VERIFY/LAREA qualifier still cause the verify to be aborted but instead of an access violation, error messages are ouput which identify the problem and the valid logical area id number range for the target database.

```
$ RMU/VERIFY/NOLOG/LAREA=0 MF_PERSONNEL
%RMU-W-BADLAREA,  could not ready logical area 0,
                  valid logical areas are between 1 and 104
%RMU-F-NOTLAREA,  "0" is not a valid logical area name or number
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
$ RMU/VERIFY/NOLOG/LAREA=65888525 MF_PERSONNEL
%RMU-W-BADLAREA,  could not ready logical area 65888525,
                  valid logical areas are between 1 and 104
%RMU-F-NOTLAREA,  "65888525" is not a valid logical area name or number
%RMU-F-ABORTVER,  fatal error encountered; aborting verification
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.12 RMU/BACKUP/LIBRARIAN Ignored Specified Block Sizes Over 32256

The /BLOCK_SIZE qualifier, when used with the Oracle Rdb RMU/BACKUP/LIBRARIAN command, allows the user to specify a numeric block size in bytes when an Rdb database backup file is written to a media management product which supports the Oracle Media Management API interface. A block size between 2048 bytes (512*4) and 65024 bytes (512*127) can be specified. The block size will be rounded up to the nearest multiple of 512 bytes if necessary. The default block size is 32256 bytes (512*63).

There was a problem which caused any block size specified with the /BLOCK_SIZE qualifier which was larger than 32256 bytes to be ignored even though a specified block size up to 65024 bytes was accepted as a valid value. In these cases, the default block size of 32256 was actually used and specified to the media management product.

This problem has been fixed and now the full range of values between 2048 and 65024 that can be specified with the BLOCK_SIZE qualifier will be used and specified to the media management product. A default block size value of 32256 bytes will continue to be the default if the /BLOCK_SIZE qualifier is not used with the RMU/BACKUP/LIBRARIAN command. Values specified by the /BLOCK_SIZE qualifier within the valid range will continue to be rounded up to the nearest multiple of 512 bytes as necessary.

The following example shows the problem. The first two backup commands show that block size values in bytes specified by the /BLOCK_SIZE qualifier must be between 2048 and 65024 bytes. The third backup command shows that even though a valid block size of 65024 is specified, the default block size of 32256 bytes is actually used. Note that a special debug logical is defined to show the actual block size passed to the media management product. Not all of the debug information output by this logical has been shown in the example.

```
$ RMU/BACKUP/LIBRARIAN=(WRITER=1)/BLOCK_SIZE=2047/NOLOG MF_PERSONNEL MFP.RBF
%RMU-F-VALLSSMIN, value (2047) is less than minimum allowed value (2048) for
BLOCK_SIZE
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at dd-mmm-yyyy hh:mm:ss.xxxx
$ RMU/BACKUP/LIBRARIAN=(WRITER=1)/BLOCK_SIZE=65025/NOLOG MF_PERSONNEL MFP.RBF
%RMU-F-VALGTRMAX, value (65025) is greater than maximum allowed value (65024)
for BLOCK_SIZE
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at dd-mmm-yyyy hh:mm:ss.xxxx
```

```
$
$ DEFINE RMU$DEBUG_SBT 1
$ RMU/BACKUP/LIBRARIAN=(WRITER=1)/BLOCK_SIZE=65024/NOLOG MF_PERSONNEL MFP.RBF

rmuio_sbtbackup called, block_size = 32256

$ DEASSIGN/NOLOG RMU$DEBUG_SBT
```

The following example shows that this problem has been fixed. Now all valid block size values between 2048 and 65024 bytes will be used and passed to the media management product. Values specified by the /BLOCK_SIZE qualifier within the valid range will continue to be rounded up the the nearest multiple of 512 bytes as necessary.

```
$ DEFINE RMU$DEBUG_SBT 1
$ RMU/BACKUP/LIBRARIAN=(WRITER=1)/BLOCK_SIZE=65024/NOLOG MF_PERSONNEL MFP.RBF

rmuio_sbtbackup called, block_size = 65024

$ DEASSIGN/NOLOG RMU$DEBUG_SBT
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.13 RMU/RESTORE/ONLY_ROOT Did Not Support the /ENCRYPT Qualifier

The RMU/RESTORE/ONLY_ROOT command restores only the root file (*.RDB) from a backup file (*.RBF) of an Oracle Rdb database. There was a problem which caused the RMU/RESTORE/ONLY_ROOT command to not support the /ENCRYPT qualifier which must be used to restore database files from encrypted Rdb backup files. The only workaround was to do a full restore of all of the Rdb database files including the root file, since the /ENCRYPT command is supported for a full restore of the database.

This problem has been fixed and now the /ENCRYPT qualifier can be used with the RMU/RESTORE/ONLY_ROOT command to restore only the database root file from an encrypted database backup file (*.RBF) created by using the /ENCRYPT qualifier with the RMU/BACKUP command.

The following example shows the problem. The RMU/BACKUP command backs up the MF_PERSONNEL database to the encrypted backup file MF_PERSONNEL_BCK.RBF using the /ENCRYPT qualifier. Then the MF_PERSONNEL database is deleted and then restored from the encrypted MF_PERSONNEL_BCK.RBF using the /ENCRYPT command to de−encrypt the restored database files. Then the restored MF_PERSONNEL.RDB database root file is deleted. When the first RMU/RESTORE/ONLY_ROOT command is used to restore the deleted database root file, an error is output because the /ENCRYPT qualifier must be used to de−encrypt the encrypted backup file. But when the /ENCRYPT qualifier was then specified with the second RMU/RESTORE/ONLY_ROOT command, the root file restore failed because the RMU/RESTORE/ONLY_ROOT command did not support the /ENCRYPT qualifier.

```
$ RMU/BACKUP/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG −
 MF_PERSONNEL.RDB MF_PERSONNEL_BCK.RBF
%RMU−I−ENCRYPTUSED, Encryption key required when future restore performed.
$ SQL
DROP DATABASE FILENAME MF_PERSONNEL;
EXIT;
$ RMU/RESTORE/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOCDD/NOLOG
MF_PERSONNEL_BCK
%RMU−I−AIJRSTAVL, 0 after−image journals available for use
```

```
%RMU-I-AIJISOFF, after-image journaling has been disabled
%RMU-W-USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/VERIFY/NOLOG MF_PERSONNEL
$ DELETE MF_PERSONNEL.RDB;*
$ RMU/RESTORE/ONLY_ROOT/NOLOG MF_PERSONNEL_BCK
%RMU-F-ENCRYPTSAVSET, save set is encrypted, /ENCRYPT must be specified
%RMU-F-FATALERR, fatal error on RESTORE_ROOT_ONLY
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 21-JUN-2012 09:31:56.41
$ RMU/RESTORE/ONLY_ROOT/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG
MF_PERSONNEL_BCK.RBF
%DCL-W-IVQUAL, unrecognized qualifier - check validity, spelling, and placement
\ENCRYPT\
```

The following example shows that this problem has been fixed. The RMU/BACKUP command backs up the MF_PERSONNEL database to the encrypted backup file MF_PERSONNEL_BCK.RBF using the /ENCRYPT qualifier. Then the MF_PERSONNEL database is deleted and then restored from the encrypted MF_PERSONNEL_BCK.RBF using the /ENCRYPT command to de-encrypt the restored database files. Then the MF_PERSONNEL.RDB database root file is deleted. When the first RMU/RESTORE/ONLY_ROOT command is used to restore the deleted database root file, an error is output because the /ENCRYPT qualifier must be used to de-encrypt the encrypted backup file. Now when the /ENCRYPT qualifier is then specified with the second RMU/RESTORE/ONLY_ROOT command, the root file restore succeeds because the RMU/RESTORE/ONLY_ROOT command now supports the /ENCRYPT qualifier.

```
$ RMU/BACKUP/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG -
 MF_PERSONNEL.RDB MF_PERSONNEL_BCK.RBF
%RMU-I-ENCRYPTUSED, Encryption key required when future restore performed.
$ SQL
DROP DATABASE FILENAME MF_PERSONNEL;
EXIT;
$ RMU/RESTORE/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOCDD/NOLOG
MF_PERSONNEL_BCK
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
%RMU-W-USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/VERIFY/NOLOG MF_PERSONNEL
$ DELETE MF_PERSONNEL.RDB;*
$ RMU/RESTORE/ONLY_ROOT/NOLOG MF_PERSONNEL_BCK
%RMU-F-ENCRYPTSAVSET, save set is encrypted, /ENCRYPT must be specified
%RMU-F-FATALERR, fatal error on RESTORE_ROOT_ONLY
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 21-JUN-2012 09:45:52.41
$ RMU/RESTORE/ONLY_ROOT/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG
MF_PERSONNEL_BCK.RBF
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
$ RMU/VERIFY/NOLOG MF_PERSONNEL
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.14 RdbALTER Documented Syntax LOCKED_SPACE Returned a Syntax Error

Bug 14225192

The Oracle Rdb RdbALTER utility, invoked by the RMU/ALTER command, provides a low-level patch capability that allows the user to make changes to Rdb database pages and other structures. The Oracle RMU

Reference Manual describes the LOCKED_SPACE parameter used with the RdbALTER DEPOSIT and DISPLAY commands as a "2−byte field" on a database page which indicates "how much free space is allocated for exclusive use by a recovery unit". However, the RdbALTER utility output a syntax error when the LOCKED_SPACE syntax was specified because RdbALTER mistakenly expected the syntax LOCKED_FREE_SPACE to be used instead of the documented syntax LOCKED_SPACE. This problem has been fixed and now the RdbALTER utility will use the documented syntax LOCKED_SPACE instead of LOCKED_FREE_SPACE. The undocumented LOCKED_FREE_SPACE syntax will no longer be accepted.

The following example shows the problem. When the RdbALTER utility was invoked and the LOCKED_SPACE parameter was used with the DEPOSIT or DISPLAY command to change or display the locked space value on the specified page, a syntax error was returned. When the incorrect undocumented value LOCKED_FREE_SPACE was used it was accepted by RdbALTER.

```
$ RMU/ALTER MF_PERSONNEL
%RMU−I−ATTACH, now altering database "DISK:[DIRECTORY]MF_PERSONNEL.RDB;1"

RdbALTER> radix decimal
RdbALTER> area 2 page 25
RdbALTER> deposit locked_space = 100
%RMU−F−SYNTAX, syntax error near " locked_space = 100"
RdbALTER> display locked_space
%RMU−F−SYNTAX, syntax error near " locked_space"
RdbALTER> deposit locked_free_space = 100
RdbALTER> display locked_free_space
                            0064  0012  100 bytes locked

RdbALTER> rollback
RdbALTER> exit
$
```

The following example shows that this problem has been fixed. Now when the RdbALTER utility is invoked and the correct and documented LOCKED_SPACE parameter is used with the DEPOSIT or DISPLAY command to change or display the locked space value on the specified page, it is accepted by RdbALTER.

```
$ RMU/ALTER MF_PERSONNEL
%RMU−I−ATTACH, now altering database "DISK:[DIRECTORY]MF_PERSONNEL.RDB;1"

RdbALTER> radix decimal
RdbALTER> area 2 page 25
RdbALTER> deposit locked_space = 100
RdbALTER> display locked_space
                            0064  0012  100 bytes locked
RdbALTER> locked_space = 99
RdbALTER> display locked_space
                            0063  0012  99 bytes locked
RdbALTER> commit
RdbALTER> exit
$
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

5.4.15 RMU/REPAIR/INIT=TSN Does Not Initialize Snapshots

In prior releases of Oracle Rdb V7.2, an RMU/REPAIR/INITIALIZE=TSN command did not initialize the snapshot files unless you explicitly specified the SNAPSHOT keyword on the /INITIALIZE qualifier, as in the following example.

```
RMU/REPAIR/INITIALIZE=(TSN,SNAPSHOT) databasename
```

If the snapshot files are not initialized along with the TSNs (Transaction Sequence Number), any previously used snap page would not get re−used until the current TSN value grew back to the pre−initialized value, causing snapshot files to grow needlessly.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. When you perform an RMU/REPAIR/INITIALIZE=TSN command, snapshot files will automatically be initialized, effectively performing an RMU/REPAIR/INITIALIZE=(TSN,SNAP) command. Currently, there is no way to override this change of behavior.

5.5 RMU Show Statistics Errors Fixed

5.5.1 RMU/SHOW STATISTICS/CLUSTER Did Not Show Transaction Type

Bug 10009143

In releases prior to Oracle Rdb Release 7.2.5.2, there was a problem in the RMU/SHOW STATISTICS/CLUSTER command where the Transaction Type was not being displayed on the Checkpoint Information screen, when the transaction was executed on a node other than the current node. This problem only occurred when the RMU command was executed on an Itanium system.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. RMU now shows the transaction type on the Checkpoint Information screen.

5.5.2 RMU Show Statistics Not Using the Full Screen Size for Details

Bugs 13892668 and 13359835

In prior versions of Oracle Rdb, the RMU Show Statistics display did not fully use the size of the display and, in some cases, limited the output to 17 lines of details.

This problem has been corrected in Oracle Rdb Release 7.2.5.2. RMU Show Statistics now uses more screen space when available. The screen size is determined by the terminal page size (SET TERMINAL/PAGE) or when using the /ROW qualifier on RMU Show Statistics.

5.6 Hot Standby Errors Fixed

5.6.1 Checksum Errors on Database Replication Between VMS IA64 and Alpha

Bug 13485968

When database replication was activated between an Oracle Rdb database on a VMS IA64 cluster node and an Oracle Rdb database on a VMS Alpha cluster node, replication could fail due to a checksum error returned when CONNECT REQUEST messages were sent from the MASTER database node to the STANDBY database node. This problem did not occur if both databases were on VMS IA64 nodes or if both databases were on VMS Alpha nodes. This checksum error was due to differences between the way the same checksum algorithm was implemented on the two VMS platforms and occurred for certain CONNECT REQUEST message lengths which depended on the number of active AIJ files. This problem was not related to any data corruption. This problem has now been fixed.

The following example shows the problem. When replicating an Rdb database between a VMS IA64 cluster node and a VMS Alpha cluster node, a checksum error is reported by the Rdb LCS server running on the MASTER node. The LCS server log shows that when the LCS server on the MASTER node sends the CONNECT REQUEST message to the Rdb AIJ server on the STANDBY node, a difference between the way a checkpoint message validation value is calculated on the different platforms causes a checksum error contained in a CONNECT NAK reply message to be returned from the AIJ server on the STANDBY node to the LCS server on the MASTER node which indicates the connection request has failed because of a checksum error.

```
$ RMU/REPLICATION AFTER START
%RDMS-F-CHECKSUM, checksum error - computed 00000000, page contained
000F0003
%RMU-F-FATALRDB, Fatal error while accessing Oracle Rdb.
%RMU-F-FTL_RMU, Fatal error for RMU operation at  26-JAN-2012
16:37:33.05
$ TYPE LCS_M_2257B0F5.LOG
 26-JAN-2012 13:56:51.17 - AIJ Log Catch-Up Server (LCS) activated

 26-JAN-2012 13:56:51.27 - Sending "Connect_Req" (MSN 0) LRS reply
 expected
 26-JAN-2012 13:56:51.27 - Using network connection 0 [4]
 26-JAN-2012 13:56:51.27 - Using network connection 0 [2]
 26-JAN-2012 13:56:51.27 - Reading 512 message
 26-JAN-2012 13:56:51.38 - setting BUF_LEN=512
 26-JAN-2012 13:56:51.38 - Using network connection 0 [3]
 26-JAN-2012 13:56:51.38 - New AIJSERVER invocation detected (PID
 2253A635)
 26-JAN-2012 13:56:51.38 - Received "Connect_Nak" reply
 26-JAN-2012 13:56:51.38 - AIJSERVER replied
------------------------------------------------------------------------------

 26-JAN-2012 13:57:23.59 - Shutdown reason: "CONNECT_REQ failed"

------------------------------------------------------------------------------
 26-JAN-2012 13:57:23.59 - LCSSRV$SHUTDOWN CODE=6
 26-JAN-2012 13:57:23.61 - Unexpected error LCS004: 00DDA5A4 - %RDMS-F-CHECKSUM,
 checksum error - computed 00000000, page contained 000F0003
```

```
 26-JAN-2012 13:57:23.61 - Sending LSS_SHUTDOWN (0:1)
 26-JAN-2012 13:57:23.61 - Changing LSS state from "Connecting" to "Shutdown"
 26-JAN-2012 13:57:23.61 - Connect request rejected: %RDMS-F-CHECKSUM,
 checksum error - computed 00000000, page contained !XL
 26-JAN-2012 13:57:23.61 - LCSSRV$SHUTDOWN CODE=5
 26-JAN-2012 13:57:23.61 - Unexpected error LCS004: 00DDA5A4 - %RDMS-F-CHECKSUM,
 checksum error - computed 00000000, page contained 000F0003
 26-JAN-2012 13:57:23.61 - Sending LSS_SHUTDOWN (1:1)
 26-JAN-2012 13:57:23.61 - Sending LCS_ACTIVE (1:0)
 26-JAN-2012 13:57:23.61 - Sending LSS_ACTIVE (0:0)
 26-JAN-2012 13:57:23.61 - Shutdown complete
```

The following example shows that this problem has been fixed. Rdb database replication succeeds between a VMS cluster IA64 node and a VMS cluster Alpha node. The Rdb LCS server log shows that the checksum value used to validate the CONNECT REQUEST message has been calculated the same on both platforms. This time the Rdb AIJ server on the STANDBY node passes the CONNECT REQUEST message on to the Rdb LRS server on the STANDBY node which sends back a CONNECT ACK reply message to the LCS server on the MASTER node indicatng that the CONNECT REQUEST has been accepted and database replication can now proceed.

```
$ RMU/REPLICATION AFTER START
$ TYPE LCS_M_21D60A44.LOG

 3-JAN-2012 15:28:51.17 - AIJ Log Catch-Up Server (LCS) activated

 3-FEB-2012 15:29:33.80 - Sending "Connect_Req" (MSN 0) LRS reply expected
 3-FEB-2012 15:29:33.80 - Using network connection 0 [4]
 3-FEB-2012 15:29:33.80 - Using network connection 0 [2]
 3-FEB-2012 15:29:33.80 - Reading 512 message
 3-FEB-2012 15:29:35.21 - setting BUF_LEN=512
 3-FEB-2012 15:29:35.21 - Using network connection 0 [3]
 3-FEB-2012 15:29:35.21 - New AIJSERVER invocation detected (PID 21D694DB)
 3-FEB-2012 15:29:35.21 - Received "Connect_Ack" reply
 3-FEB-2012 15:29:35.21 - LRS replied
```

This problem has been corrected in Oracle Rdb Release 7.2.5.2.

Chapter 6
Software Errors Fixed in Oracle Rdb Release 7.2.5.1

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.1.

6.1 Software Errors Fixed That Apply to All Interfaces

6.1.1 Unexpected Memory Allocation Failure When Accessing Remote Database

Bug 12760132

In certain cases when accessing a remote database, there could be a small memory leak where memory was allocated and never released. If this situation continued for a significant length of time, Rdb could exhaust the available memory resulting in unusual errors.

Using an explicit SET TRANSACTION or START TRANSACTION contributes to this problem.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.2 Alignment Faults on Itanium Using Multiple Mapped Index Columns

Bug 13552628

In prior releases of Oracle Rdb on the Itanium platform, significant numbers of alignment faults in EXEC mode would occur when creating indices with multiple mapped columns. This negatively affected system performance.

```
drop table t1 cascade if exists;
create table t1
 (f1 bigint, f2 integer, f3 integer);
$write sys$output "Start of populating the table."
begin
declare :i integer;
for :i in 1 to 1000000 step 1
do
insert into t1 values (:i, 1, 1);
end for;
end;
$write sys$output "Start of index creation."
create unique index i1 on t1 (f1 asc,
  f2 mapping values 0 to 32767 asc,
  f3 mapping values 0 to 32767 asc)
type is sorted ranked;
```

The number of alignment faults can be observed by using the MONITOR ALIGNMENT command on another screen on the same system.

There is no known workaround for this problem.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.3 Problem Writing Large TSN Values to Data and Snap Pages

Bug 12741822

A problem has been discovered that could affect how Transaction Sequence Numbers (TSNs) are stored on data and snapshot pages. This problem only occurs when TSNs have a value greater than 4,294,967,295.

A TSN is a sequentially increasing number associated with an Rdb database transaction. A unique TSN is assigned at the start of an update transaction and represents when the transaction started relative to other transactions.

TSNs are used throughout Rdb memory data structures. Additionally, Rdb writes the TSN to on−disk structures such as data files, snapshot files, and after−image journal (AIJ) files to reflect which transaction modified a particular row. Read−only transactions use the TSNs stored on data and snapshot pages to determine which version of a modified row can be seen by the reader.

The problem occurs due to a change to Rdb Version 7.0 in how TSNs are stored on data and snap pages. Prior to that version, TSNs were 32−bit integers with a maximum value of 4,294,967,295. With 7.0, the size of the TSN field was changed to be a 64−bit integer. So as not to require a database unload and reload to support the larger field size, an algorithm was devised to break up those TSNs that would no longer fit into a 32−bit field into 2 pieces when the page is updated. The original value would be regenerated prior to reading from the page.

Recently, it was discovered that this algorithm could cause such large TSNs to possibly be stored incorrectly. Occurrences would be more prevalent during the window where some active transaction would have TSN values greater than the 32−bit maximum while others had values less than that maximum.

The problem may manifest itself with errors during an RMU /VERIFY /ONLINE, or with incorrect data returned from read−only transactions. Additionally, an RMU /BACKUP /ONLINE may produce a backup file that will restore a corrupted database (although an RMU /RECOVER of all spanning after−journal files will usually fix the corruption).

If you believe that your database exhibits these symptoms, you can use the offline RMU /REPAIR /INIT=TSN operation to reset the TSNs. Before running this command, you must have, as a minimum Rdb version, either the V7.2.4.2 Update 4 kit or this release installed. Refer to the release note "Problem With RMU/REPAIR/INIT=TSNS When TSNs Exceed 4,294,967,295".

The problem has been fixed in Oracle Rdb Release 7.2.5.1. TSNs will now be stored correctly on data pages.

6.1.4 Query With Complex Shared OR Predicates Returns Wrong Result

Bug 12690624

The customer demonstrates, using the following reproducer, that the inner join query with complex OR predicates returns wrong results (3 rows instead of 0 rows).

```
SELECT T2.NSEG, T2.SENS
```

```
FROM (((C_AVG T0
        INNER JOIN C_SBT T1 ON T0.C_COD_LIG = T1.C_COD_LIG)
        INNER JOIN C_SGU T2 ON T1.NSEG  = T2.NSEG)
        INNER JOIN C_ETU T3 ON T3.NITIN = T2.NITIN)
        INNER JOIN C_ITI T4 ON T4.NITIN = T3.NITIN
WHERE
  T3.IDAT  = 99999 AND T0.NUMAG = '999 XXX' AND
  -- BLOC 1:
  (T0.DEBU = T0.PFIN AND T0.DEBU >= T1.DEBU AND T0.DEBU <= T1.PFIN) AND
  -- BLOC 3:
  ((SELECT COUNT(*)
      FROM (C_BOUC T5 INNER JOIN C_OBST T6 ON T6.ID_OBST = T5.ID_OBST)
              INNER JOIN C_VOBST T7 ON
                  T7.ID_OBST = T5.ID_OBST AND T7.CLIG = T5.CLIG AND
                  T7.NOMV = T5.NOMV
      WHERE T5.NUMAG = T0.NUMAG AND T5.ACT = 1 AND T6.ACT = 1 AND
        -- BLOC 3a:
        (T6.DEBU = T6.PFIN AND T6.DEBU >= T1.DEBU AND T6.DEBU <= T1.PFIN) AND
        -- BLOC 3b:
         -- Segment A OR
        ((T2.PSEG = 2 AND T2.SENS = 0 AND T6.DEBU >= T4.FITI) OR
         -- Segment B
         (T2.PSEG = 3 AND T6.DEBU <> T6.PFIN AND T2.SENS = 1 AND
          T6.PFIN > T4.DITI AND T6.DEBU < T4.FITI)) AND
        -- BLOC 3c:
        (T3.UTLP = 1 AND
         ((T2.SENS = 0 AND T7.SCIR = 7) OR         ! T2_SENS = 0 is shared
          (T2.SENS = 1 AND T7.SCIR IN (1,3, 8))))  ! T2_SENS = 1 is shared
    ) > 0               -- count > 0
   );
 T2.NSEG   T2.SENS
    2181         0
    2181         0
    2181         0
3 rows selected
```

There is no workaround for this problem.

The key parts of this query which contributed to the situation leading to the error are these:

1. The main query is an inner join of five tables, with a WHERE clause containing a COUNT sub−query of 3 tables inner joined.
2. The sub−query contains the complex expression with AND and OR predicates.
3. Some of the operands inside the last OR predicates are shared by the previous OR predicates.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.5 Query With Shared OR Predicates Returns Wrong Result

Bug 12632105

A customer demonstrates, using the following simple reproducer, that this query returns wrong results.

```
create database filename testdb
create table tab1 (
       col1 bigint, col2 integer, col3 tinyint, col4 tinyint);
```

```
create table tab2 (col1 bigint);
insert into tab1 values (1000000,900000,11,2);
commit;
```

The following query should return no rows but it returns one row.

```
SELECT col2, col3, col4
 from TAB1 T1 where
 col3 in (15,13,11)
        and
   (
      (col3 = 15 and
           ((col4 = 6) or
            (col4 = 2 and
                exists (select * from TAB2 T2
                        where T1.col1 = T2.col1)
             )
            )
       )
   or
     (col2 between 1000000 and 1500000 and
           ((col3 = 11 and col4 = 2) or
            (col3 = 13 and col4 = 1)
           )
      )
     )
 and col1 = 1000000;
Tables:
  0 = TAB1
  1 = TAB2
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: (0.COL3 = 15) OR (0.COL3 = 13) OR (0.COL3 = 11)
    Conjunct: 0.COL1 = 1000000
    Get     Retrieval sequentially of relation 0:TAB1
  Cross block entry 2
    Aggregate-F1: 0:COUNT-ANY (<subselect>) Q2
    Conjunct: 0.COL1 = 1.COL1
    Get     Retrieval sequentially of relation 1:TAB2
        COL2   COL3   COL4
      900000     11      2
1 row selected
```

However, moving "col3 in (15,13,11)" to the end returns the correct result, as seen in the following example.

```
SELECT col2, col3, col4
 from TAB1 T1 where
   (
      (col3 = 15 and
           ((col4 = 6) or
            (col4 = 2 and
                exists (select * from TAB2 T2
                        where T1.col1 = T2.col1)
             )
            )
       )
   or
     (col2 between 1000000 and 1500000 and
           ((col3 = 11 and col4 = 2) or
            (col3 = 13 and col4 = 1)
           )
```

```
      )
     )
 and col1 = 1000000
 and col3 in (15,13,11);
Tables:
  0 = TAB1
  1 = TAB2
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 0.COL1 = 1000000
    Conjunct: (0.COL3 = 15) OR (0.COL3 = 13) OR (0.COL3 = 11)
    Get     Retrieval sequentially of relation 0:TAB1
  Cross block entry 2

    Conjunct: (((0.COL3 = 15) AND ((0.COL4 = 6) OR ((0.COL4 = 2) AND (<agg0> <>
              0)))) OR ((0.COL2 >= 1000000) AND (0.COL2 <= 1500000) AND (((
              0.COL3 = 11) AND (0.COL4 = 2)) OR ((0.COL3 = 13) AND (0.COL4 = 1))
              ))) AND ((0.COL3 = 15) OR (0.COL3 = 13) OR (0.COL3 = 11))
    Aggregate-F1: 0:COUNT-ANY (<subselect>) Q2
    Conjunct: (0.COL3 = 15) OR (0.COL3 = 13) OR (0.COL3 = 11)
    Conjunct: 0.COL1 = 1.COL1
    Get     Retrieval sequentially of relation 1:TAB2
0 rows selected
```

The key parts of this query which contributed to the situation leading to the error are these:

1. The query contains an expression with nested AND and OR predicates.
2. Some of the operands inside the OR predicates are shared (the same expression).
3. The placing of one of the OR predicates as part of the AND operation changes the outcome.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.6 Query With LSS, LEQ and NOT NULL Predicate Returns Wrong Result on Itanium System

Bug 12794427

The customer demonstrates, using the following simple reproducer, that a query with LSS, LEQ and NOT NULL returns wrong results.

```
create table T1(f1 char(8), f2 char(4), f3 integer);

insert into T1 values ('03901605' , '1',1);
insert into T1 values ('03901605' , ' ',2);
insert into T1 values ('03901605' , '    ',3);
insert into T1 values ('03901605' , x'01000000',4);
insert into T1 values ('03901605' ,null,1);

creat index T1_idx1 on T1(f1,f2);

select f1, f2, translate (f2 using rdb$hex), f3 from T1;
 F1         F2                          F3
 03901605   ....   01000000             4
 03901605          20202020             2
 03901605          20202020             3
 03901605   1      31202020             1
 03901605   NULL   NULL                 1
```

```
5 rows selected

! should find 4 rows
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 is not null;
 F1         F2                          F3
 03901605          20202020             2
 03901605          20202020             3
 03901605   1      31202020             1
3 rows selected

! should find 1 row
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 < '';
0 rows selected

! should find 3 rows
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 <= '';
 F1         F2                          F3
 03901605          20202020             2
 03901605          20202020             3
2 rows selected

!should find 1 row
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 < x'20';
0 rows selected

!should find 3 rows
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 <= x'20';
 F1         F2                          F3
 03901605          20202020             2
 03901605          20202020             3
2 rows selected

!should find 1 row
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 <= x'01000000';
0 rows selected

!should find 1 row
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 < x'01';
0 rows selected

!should find 1 row
select f1, f2, translate (f2 using rdb$hex), f3 from T1
where f1 = '03901605' and f2 <= x'01';
0 rows selected
```

The problem occurs when the values of the data are less than or equal to a space character.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.7 SQLSRV−E−PWDEXPIRED Error Restored

Bugs 11831591 and 13039749

In Oracle SQL/Services releases prior to 7.3.0.3, if a user account's password lifetime was set, an attempt to connect after the password expired got the SQLSRV−E−PWDEXPIRED error. When intrusion detection was added in Release 7.3.0.3 of SQL/Services, this error changed to SQLSRV−F−GETACCINF. Therefore, applications were unable to trap expired/lifetime exceeded password errors in order to prompt the user for a new password.

An account's password will expire if the account's /PWDLIFETIME or /EXPIRATION is set and the current date/time is later than the set date/time.

SQLSRV−E−PWDEXPIRED is also returned if either of the PWD_EXPIRED or PWD2_EXPIRED flags are set in the system UAF file.

A new Oracle SQL/Services Kit is NOT required to correct this problem. This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.8 Incorrect Results on IA64 using Partitioned Descending Index

Bug 6129797

Starting with Oracle Rdb Release 7.2.4, it was possible for some queries using partitioned indexes with segments of mixed ascending and descending order to return incorrect results on IA64 systems effected by this problem.

The following examples show two problems when using partitioned indexes with segments of mixed ascending and descending order:

```
create database file foo
        create storage area fooa
        create storage area foob;

create table mesa (id integer, m4 char (1), m5 integer);
create table rasa (id integer, r4 char (1), r5 integer);

insert into mesa (id, m4, m5) values  (1, 'm', 1 );
insert into rasa (id, r4, r5) values  (1, 'm', 1 );

create index x4 on mesa (id asc , m4 asc) ;

create index y4 on rasa (id asc , r4 desc)
       store using (id, r4)
       in fooa with limit of (1, 'g' )
       otherwise in foob ;
commit;

! the following query returns correctly 3 rows on Alpha but 1 row on IA64:
SQL> sh version
Current version of SQL is: Oracle Rdb SQL X7.2−00
Underlying versions are:
    Database with filename foo
        Oracle Rdb X7.2−00
        Rdb/Dispatch X7.2−01 (OpenVMS Alpha)

SQL> select m.id, m.m4, r.r4 from
   mesa m inner join rasa r on (m.id = r.id);
```

```
           1   m      m
           1   m      k
           1   m      e
3 rows selected

SQL> sh version
Current version of SQL is: Oracle Rdb SQL X7.2−00
Underlying versions are:
    Database with filename foo
        Oracle Rdb X7.2−00
        Rdb/Dispatch X7.2−01 (OpenVMS IA64)

SQL> select m.id, m.m4, r.r4 from mesa m inner join rasa r on (m.id = r.id);
           1   m      e
1 row selected
```

This problem is related to the construction and comparison of the descending key values during the index partitions.

The problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.1.9 Unexpected Failure When Identity Sequence is Not Granted Access

Bug 13248799

Oracle Rdb creates a special sequence when the IDENTITY clause is used in a CREATE TABLE or ALTER TABLE statement. However, subsequent use of the GRANT statement on the table would not modify the protections on the matching identity sequence. In such cases, the INSERT statement might fail even when the user was granted INSERT privilege on the table.

The following example shows the reported error. As you can see, it is confusing since the user clearly has INSERT privilege on the table.

```
SQL> show privileges on table T;
Privileges on Table T
    (IDENTIFIER=[RDB,TESTER],ACCESS=SELECT+INSERT)
SQL>
SQL> insert into T default values;
%RDB−E−NO_PRIV, privilege denied by database facility
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. The GRANT statement will now propagate the SELECT privilege to the identity sequence when INSERT is granted on the table. Likewise, a REVOKE statement will remove the SELECT privilege from the identity sequence when INSERT is revoked from the table.

6.1.10 LIMIT TO/ORDER BY Query With OR Predicate Returns Wrong Result

Bug 13554836

The customer demonstrates, using the following simple reproducer, that the LIMIT TO/ORDER BY query with OR predicate returns the wrong result.

```
select DFID,TID,TT_ID from DF;
     DFID               TID     TT_ID
 15307659         313954196         2
  3571816         803166548         1
 18736151         216931932         1
3 rows selected

select * from NT;
 ITEM_IND           ITEM_ID   USER_ID
 F                   3039532   DARMAWANT
 F                   3571816   YAPT
 F                  18736151   GSHG
 T                  15643968   SYSTEM
 T                  16610114   SYSTEM
5 rows selected

! The value returned in the column NOTES_IND in the first row should be 'Y'
! instead of 'N'.
!
select
    TT.DFID
    ,case
        when
            (exists
                (select
                    *
                from
                    NT N
                where
                    ((N.ITEM_ID = TT.DFID and N.ITEM_IND = 'F')
                or  (N.ITEM_ID = TT.TID and N.ITEM_IND = 'T')
                or  (N.ITEM_ID = TT.PID and N.ITEM_IND = 'M'))
                and N.USER_ID <> 'SYSTEM'))
        then
            'Y'
        else
            'N'
    end NOTES_IND
from
    (select
        DF.DFID,
        DF.TID,
        DF.PID
    from
        DF DF
    ) TT
order by
   TT.DFID
limit to 150 rows;
       DFID   NOTES_IND
    3571816   N          <= this is wrong
   15307659   N
   18736151   Y
3 rows selected
```

The query works if the LIMIT TO clause is removed, as in the following example.

```
select
```

```
    TT.DFID
    ,case
        when
            (exists
                (select
                    *
                from
                    NT N
                where
                    ((N.ITEM_ID = TT.DFID and N.ITEM_IND = 'F')
                or  (N.ITEM_ID = TT.TID and N.ITEM_IND = 'T')
                or  (N.ITEM_ID = TT.PID and N.ITEM_IND = 'M'))
                and N.USER_ID <> 'SYSTEM'))
        then
            'Y'
        else
            'N'
    end NOTES_IND
from
    (select
        DF.DFID,
        DF.TID,
        DF.PID
    from
        DF DF
    ) TT
order by
   TT.DFID
!limit to 150 rows    <= removing this makes the query work
;
Tables:
  0 = DF
  1 = NT
Sort: 0.DFID(a)
Cross block of 2 entries  Q0
  Cross block entry 1
    Merge of 1 entries  Q1
      Merge block entry 1  Q2
      Get     Retrieval sequentially of relation 0:DF
  Cross block entry 2
    Aggregate-F1: 0:COUNT-ANY (<subselect>) Q3
    Conjunct: (((1.ITEM_ID = 0.DFID) AND (1.ITEM_IND = 'F')) OR (
              (1.ITEM_ID = 0.TID) AND (1.ITEM_IND = 'T')) OR ((
              1.ITEM_ID = 0.PID) AND (1.ITEM_IND = 'M'))) AND (
              1.USER_ID <> 'SYSTEM')
    OR index retrieval Q3
      Conjunct: ((1.ITEM_ID = 0.DFID) AND (1.ITEM_IND = 'F')) OR
                ((1.ITEM_ID = 0.TID) AND (1.ITEM_IND = 'T'))
      OR index retrieval Q3
        Index only retrieval of relation 1:NT
          Index name  NT_IDX [2:2]
            Keys: (1.ITEM_IND = 'F') AND (1.ITEM_ID = 0.DFID)
        Conjunct: NOT ((1.ITEM_IND = 'F') AND (1.ITEM_ID = 0.DFID
                  ))
        Index only retrieval of relation 1:NT
          Index name  NT_IDX [2:2]
            Keys: (1.ITEM_IND = 'T') AND (1.ITEM_ID = 0.TID)
      Conjunct: NOT (((1.ITEM_IND = 'F') AND (1.ITEM_ID = 0.DFID)
                ) OR ((1.ITEM_IND = 'T') AND (1.ITEM_ID = 0.TID)))
      Index only retrieval of relation 1:NT
        Index name  NT_IDX [2:2]
          Keys: (1.ITEM_IND = 'M') AND (1.ITEM_ID = 0.PID)
```

```
       DFID   NOTES_IND
    3571816   Y           <= this is correct
   15307659   N
   18736151   Y
3 rows selected
```

The problem occurs when the query contains a nested OR predicate in the inner loop of the cross strategy with ORDER BY followed by LIMIT TO clause.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.2 SQL Errors Fixed

6.2.1 THRESHOLDS Clause Not Applied to Default LIST Storage by CREATE STORAGE MAP Statement

Bug 12664565

In prior releases of Oracle Rdb, the CREATE STORAGE MAP statement did not apply THRESHOLD values to the default LIST storage area when it was referenced in the storage map definition.

The following example shows this problem. The Partition Information for the lists map does not report any THRESHOLDS for the default LIST area.

```
SQL> create storage map LISTS_MAP
cont>     store LISTS
cont>         in AREA_BLOB_1
cont>             (thresholds are (50, 60, 80))
cont>             for (BLOB_1.IMAGE)
cont>         in AREA_BLOB_DEFAULT
cont>             (thresholds are (55, 65, 85));
SQL> commit;
SQL>
SQL> show storage map lists_map
     LISTS_MAP
 For Lists
 Store clause:          STORE LISTS
        in AREA_BLOB_1
            (thresholds are (50, 60, 80))
            for (BLOB_1.IMAGE)
        in AREA_BLOB_DEFAULT
            (thresholds are (55, 65, 85))

 Partition information for lists map:
  Partition: (0) SYS_P00059
   Storage Area: AREA_BLOB_1
         Thresholds are (50, 60, 80)
  Partition: (0) SYS_P00001
   Storage Area: AREA_BLOB_DEFAULT
SQL>
```

The default LIST (or SEGMENTED STRING) area is defined by the CREATE DATABASE statement and is created at that time without thresholds. Later during CREATE STORAGE MAP, this logical area is reused without applying the desired THRESHOLDS.

This problem has been corrected in Oracle Rdb Release 7.2.5.1. This logical area is now altered by the CREATE STORAGE MAP statement to apply the thresholds clause. Note, as with other changes to logical areas, this action is deferred until COMMIT time.

6.2.2 Some CHARACTER SET Clauses Ignored by IMPORT DATABASE Statement

Bug 12740758

In prior versions of Oracle Rdb, the CHARACTER SET clauses specified on the IMPORT DATABASE statement were ignored.

With this release, the following clauses are now processed by IMPORT: DEFAULT CHARACTER SET, NATIONAL CHARACTER SET and IDENTIFIER CHARACTER SET. Their effect is to establish new values for use by new objects created after the IMPORT statement has completed.

The following example shows the problem. The character sets from the original database are retained after the IMPORT.

```
SQL> import database
cont>     from ps_export
cont>     filename ps2
cont>
cont>     default character set ISOLATIN1
cont>     national character set UTF8
cont>     identifier character set DEC_MCS
cont> ;
SQL> show connection RDB$DEFAULT_CONNECTION
Connection: RDB$DEFAULT_CONNECTION
.
.
.
Alias RDB$DBHANDLE:
        Identifier character set is ASCII
        Default character set is WIN_LATIN1
        National character set is UNICODE
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.2.3 Unexpected Bugcheck From DROP INDEX or ALTER INDEX Statements

Bug 12823968

In prior releases of Oracle Rdb, it was possible in rare cases for DROP INDEX, ALTER INDEX ... TRUNCATE PARTITION, ALTER INDEX ... TRUNCATE ALL PARTITIONS, ALTER INDEX ... REBUILD PARTITION, or ALTER INDEX ... REBUILD ALL PARTITIONS to generate a bugcheck similar to that shown below.

- Exception at 0000000081CAA251 : RDMSHRP721\DIO$FETCH_DBKEY + 000003D1
- %SYSTEM−F−ACCVIO, access violation, reason mask=00, virtual address=000000000000034C, PC=0000000081CAA251, PS=00000009
- Saved PC = 0000000080F34860 : RDMSHRP721\PSII2DESTROYDUPCHAINS + 00000430
- Saved PC = 0000000080F33AF0 : RDMSHRP721\PSII2DESTROYTREE + 000005C0
- Saved PC = 0000000080F33A60 : RDMSHRP721\PSII2DESTROYTREE + 00000530
- Saved PC = 000000008130FF40 : RDMSHRP721\RDMS$$CHANGE_INDEX + 00022F20

This problem occurs under the following conditions:

- More than one index exists for the table.
- Two or more of the indices do not include a STORE IN clause, which means these indices are stored in the default storage area by default. It also means that the index nodes from those indices will share a single logical area.
- The index being operated on is one of the indices without a STORE clause.
- The index being operated on is a SORTED RANKED index with many duplicates, enough that the compressed bit map must be split across multiple overflow nodes.
- The NUMBER OF BUFFERS used by the session is too small to contain the full chain of overflow nodes for a single key. This includes any definition of RDM$BIND_BUFFERS.

Under normal circumstances, an index in a UNIFORM logical area is processed by these DROP INDEX and ALTER INDEX statements using the fast logical area delete feature which does not need to traverse the index nodes. Therefore, defining the indices with STORE clauses or using a large NUMBER OF BUFFERS for the database can be used to avoid this problem.

The following example uses SET FLAGS with the INDEX_STATS keyword to display more information during the ALTER INDEX statement.

```
SQL> set flags 'stomap_stats,index_stats';
SQL>
SQL> alter index SAMPLE_INDEX_1 TRUNCATE ALL PARTITIONS;
~Ai alter index "SAMPLE_INDEX_1" (hashed=0, ordered=0)
~As locking table "SAMPLE_TABLE" (PR -> PU)
~Ai truncate all partitions
~Ai truncated 0 partitions, skipped 0
~Ai shared larea 80 - must destroy tree
~Ai destroy old index, root=80:59:1
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=000000000000034C, PC=FFFFFFFF81CDB220, PS=0000001B
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.2.4 Unexpected Error When Both LIKE and COMPRESSION Used in CREATE TABLE Statement

Bug 12907930

In prior releases of Oracle Rdb, attempts to use the COMPRESSION clause and the LIKE clause on a CREATE TABLE or DECLARE LOCAL TEMPORARY TABLE statement caused an exception to be raised.

The following example shows this error.

```
SQL> create table OLD_EMPLOYEES
cont>     like EMPLOYEES
cont>     compression is disabled
cont> ;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-E-BAD_CODE, corruption in the query string
SQL>
SQL> declare local temporary table module.OLD_EMPLOYEES
```

```
cont>     like EMPLOYEES
cont>     compression is disabled
cont> ;
%RDMS-E-BAD_CODE, corruption in the query string
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. SQL now generates the correct DDL definition for these combined clauses.

6.2.5 Wrong Results When UNION Mixed With EXCEPT, MINUS or INTERSECT

In prior releases of Oracle Rdb, it was possible that mixing UNION with EXCEPT, MINUS or INTERSECT could return wrong results. The EXCEPT, MINUS or INTERSECT were mistakenly transformed to UNION operators and merged into UNION operations.

The following example should return zero rows but the MINUS is handled incorrectly.

```
SQL> create table X (a int);
SQL> insert into X values (1);
1 row inserted
SQL>
SQL> select a from x
cont> minus
cont> (select a from x
cont> union distinct
cont> select a from x
cont> )
cont> ;
           A
           1
1 row selected
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. Any SQL Module Language or SQL Precompiler applications that use UNION should be recompiled after this version is installed. Applications using Dynamic or Interactive SQL will automatically get the corrected behavior upon execution of these queries.

6.2.6 Unexpected Error When Defining Trigger With INSERT ... DEFAULT VALUES Clause

In prior releases of Oracle Rdb, it was not possible to use the syntax INSERT INTO ... DEFAULT VALUES as an action in a TRIGGER definition. The syntax was accepted by SQL but the Rdb server rejected the definition as shown below.

```
SQL> create trigger c_insert
cont>     after insert on C
cont>     (trace 'insert into C';
cont>      update A set a = a + 1, b = DEFAULT)
cont>     for each row
cont>
cont>     when (C.a is NULL)
cont>         (insert into B default values)
```

```
cont>     for each row
cont>
cont>     when (C.a = FF (C.a))
cont>         (signal 'RR001' ('Unexpected value'))
cont>     for each row
cont> ;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-E-BAD_CODE, corruption in the query string
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. Oracle Rdb now correctly processes this format for the INSERT statement when present in a trigger definition.

6.2.7 Unexpected Bugcheck When Declaring a Local Temporary Table With the Same Name as a System Table

Bug 12907930

In prior versions of Oracle Rdb, it was not permitted to declare a local temporary table with the same name as a system table. In this example, the name RDB$STORAGE_MAPS is a system table which the customer wanted to load into a scratch table and perform comparisons across different databases. The unfortunate side effect is that the table metadata is unloaded as part of the error processing.

The following example shows the resulting error (and bugcheck dump) when the expected system table metadata is missing.

```
SQL> declare local temporary table module.RDB$STORAGE_MAPS
cont>    like RDBVMS$STORAGE_MAPS
cont>    on commit preserve rows;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-F-VIEW_NO_ANA, views cannot be analyzed
SQL>
SQL> create view VIEW_RDB$STORAGE_MAPS AS SELECT * FROM RDB$STORAGE_MAPS;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. Oracle Rdb now uses the context for the name to correctly cleanup the in−memory metadata.

6.3 RMU Errors Fixed

6.3.1 RMU Extract Did Not Propagate Domain Attributes

Bug 12572092

In prior versions of Oracle Rdb, RMU Extract did not propagate domain attributes (default or check constraint) when the /LANGUAGE=ANSI_SQL or /OPTION=NODOMAIN qualifiers were used.

The following example shows this.

```
SQL> create domain COL1_DOM
cont>     char
cont>     default NULL
cont>     check ((value is null
cont>             or substring(value from 1 for 1) between 'A' and 'Z'))
cont>         not deferrable
cont> ;
SQL>
SQL> create table TBL1
cont>     (col1       COL1_DOM
cont>     )
cont> ;
```

Here is the resulting extracted table when /OPTION=NODOMAIN is used. Note that neither the DEFAULT value for the column nor the CHECK constraint is extracted from the domain.

```
create table TBL1 (
    COL1
        CHAR (1));
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. RMU Extract now propagates the DEFAULT defined for the domain to each referencing column when extracted using /LANGUAGE=ANSI_SQL or /OPTION=NODOMAIN qualifiers.

RMU Extract now generates a local (column) CHECK constraint with a name derived from the source domain.

```
create table TBL1 (
    COL1
        CHAR (1)
        default NULL
        constraint COL1_DOM_1
            check(((COL1 is null)
                or SUBSTRING(COL1 from 1 for 1) between 'A' and 'Z'))
            not deferrable);
```

Note

The option Defer_Constraints of the /OPTIONS qualifier is not currently applied to the extracted domain constraint.

6.3.2 RMU/RECOVER Consistency Bugcheck When Fetching a SPAM Page

Bug 12639352

During the RMU/RECOVER of an Oracle Rdb database, if, when an AIJBL$K_DELA record in an AIJ file was processd to delete a logical area, no preceeding AIJ record in that AIJ file had previously readied the uniform storage area containing that logical area in Update permission mode and the storage area was not marked as corrupt, a consistency bugcheck would occur when fetching the SPAM page for that logical area. When this happened, the resulting RMUBUGCHK.DMP would show the following stack trace. (The following stack trace is for Oracle Rdb Release 7.2.5.0, but this problem could occur in earlier versions of Oracle Rdb as well.)

```
***** Exception at 0000000080BA0D00 : RMU72\PIO$FETCH + 000005B0
%COSI-F-BUGCHECK, internal consistency failure
Saved PC = 00000000807F5FC0 : RMU72\DIORE$DELA + 000008C0
Saved PC = 00000000807EDBD0 : RMU72\DIO$RE_DO + 00000530
Saved PC = 0000000080B38050 : RMU72\KUTREC$APPLY_AIJBL + 00000B40
Saved PC = 0000000080B2C060 : RMU72\KUTREC$DO_C_AIJBUF + 00001AF0
Saved PC = 0000000080B2A300 : RMU72\KUTREC$DO_COMMIT_QUE + 00000160
Saved PC = 0000000080B3A2B0 : RMU72\KUTREC$NORMAL_ROLLFORWARD + 000003E0
Saved PC = 0000000080B23BB0 : RMU72\KUTREC$RECOVER_JOURNAL + 00003FD0
Saved PC = 0000000080B1E730 : RMU72\KUTREC$RECOVER + 00001E30
Saved PC = 00000000805D0540 : RMU72\RMUREC$RECOVER_ACTION + 00001910
Saved PC = 00000000805CEBA0 : RMU72\RMUCLI$RECOVER + 000009D0
Saved PC = 0000000080332530 : RMU72\RMU_DISPATCH + 00001C30
Saved PC = 0000000080330150 : RMU72\RMU_STARTUP + 00000920
Saved PC = 0000000080000C20 : RMU72\ELF$TFRADR + 00000050
Saved PC = FFFFFFFF844CEE80 : Image PTHREAD$RTL + 0004AE80
Saved PC = FFFFFFFF844846C0 : Image PTHREAD$RTL + 000006C0
Saved PC = 000000007ADBF040 : Image DCL + 0006D040
```

This problem has been fixed. Now the storage area, which contains the SPAM page for the logical area being deleted, will be readied in Update mode if it has not previously been readied during the RMU/RECOVER. There is no workaround for this problem.

The following example shows the problem. First the database is restored. Then during the RMU/RECOVER an internal consistency failure occurs, the recover operation fails, and an RMUBUGCHK.DMP is created.

```
$ RMU/RESTORE/DIR=DEVICE:[DIRECTORY]/NOCDD [-]DB_NAME.RBF
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
%RMU-W-USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/RECOVER/ROOT=DEVICE:[DIRECTORY]DB_NAME.RDB/TRACE [-]DB_NAME_01.AIJ
%RMU-I-LOGRECDB, recovering database file DEVICE:[DIRECTORY]DB_NAME.RDB;1
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005673 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005674 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005675 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005676 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005677 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005678 committed
%RMU-I-LOGRECSTAT, transaction with TSN 0:16005679 committed
%COSI-F-BUGCHECK, internal consistency failure
%RMU-F-FATALOSI, Fatal error from the Operating System Interface.
%RMU-I-BUGCHKDMP, generating bugcheck dump file DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
```

The following example shows that this problem has been fixed. Following the RMU/RESTORE of the database, the RMU/RECOVER operation succeeds and a success message is output.

```
$ RMU/RESTORE/DIR=DEVICE:[DIRECTORY]/NOCDD [−]DB_NAME.RBF
%RMU−I−AIJRSTAVL, 0 after−image journals available for use
%RMU−I−AIJISOFF, after−image journaling has been disabled
%RMU−W−USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/RECOVER/ROOT=DEVICE:[DIRECTORY]DB_NAME.RDB/TRACE [−]DB_NAME_01.AIJ
%RMU−I−LOGRECDB, recovering database file DEVICE:[DIRECTORY]DB_NAME.RDB;1
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005673 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005674 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005675 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005676 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005677 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005678 committed
%RMU−I−LOGRECSTAT, transaction with TSN 0:16005679 committed
%RMU−I−AIJONEDONE, AIJ file sequence 133 roll−forward operations completed
%RMU−I−AIJALLDONE, after−image journal roll−forward operations completed
%RMU−I−AIJSUCCES, database recovery completed successfully
%RMU−I−AIJFNLSEQ, to start another AIJ file recovery, the sequence number
needed will be 134
%RMU−I−AIJNOENABLED, after−image journaling has not yet been enabled
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.3.3 Problems If a Full RMU/BACKUP Was Not Done After RMU/MOVE_AREA

Bug 13070493

Problems occurred if a full database backup of an Oracle Rdb database was not done following an RMU/MOVE_AREA command. If a full database backup that was done previous to the RMU/MOVE_AREA command was later restored, followed by the restore of an incremental database backup done after the RMU/MOVE_AREA command, changes to the database root file made by the RMU/MOVE_AREA command were lost. This would undo the results of the RMU/MOVE_AREA command and sometimes cause database corruption. To prevent this, the following error will now be returned if the next online or offline database backup command executed following an RMU/MOVE_AREA command will not produce a full database backup, and the backup will not be allowed.

```
$ rmu/backup/nolog/incremental mf_personnel.rdb mfp.rbf
%RMU−F−NOFULLBCK, no full backup of this database exists
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 11−OCT−2011
12:02:18.08
```

If an RMU/DUMP/HEADER command is executed following an RMU/MOVE_AREA command, and a full database backup has not yet been executed, the following warning line will appear in the "Database Backup" section of the dump.

```
    Database Backup...

      − Incremental backup not allowed until full backup
```

Once a full online or offline database backup is executed following the RMU/MOVE_AREA command, incremental database backups can be executed and an RMU/DUMP HEADER command will no longer show

the above warning line in the "Database Backup" section of the dump. Note that Rdb already requires a full database backup to be made following certain changes made to the database root such as adding and reserving storage areas and defining new nodes and users. These existing cases also cause the incremental backup to fail with the same error message and the above warning line to appear in the output of the RMU/DUMP/HEADER command until a full database backup is executed.

The following example shows the problem. The full database backup is done before the move of the DEPARTMENTS storage area to the new directory. The incremental database backup is done after the move. When the full restore is done, the database root is restored as it was before the move was done. This does not corrupt the database in this particular case but it does undo the move of the DEPARTMENTS storage area to the new directory.

```
$ rmu/backup/online/nolog mf_personnel mf_personnel_full
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1234','Testing A','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1235','Testing B','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1236','Testing C','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1237','Testing D','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1238','Testing E','11111',20000,20000);
1 row inserted
commit;
exit;
$ RMU/MOVE_AREA/DIRECTORY=[.move_db]/NOLOG -
  device:[directory]mf_personnel.rdb -
  DEPARTMENTS
%RMU-W-DOFULLBCK, full database backup should be done to ensure future recovery
%RMU-I-COMPLETED, MOVE_AREA operation completed at 11-OCT-2011 12:07:15.40
$ dir departments.*
%DIRECT-W-NOFILES, no files found
$ dir [.move_db]departments.*

Directory DEVICE:[DIRECTORY.MOVE_DB]

DEPARTMENTS.RDA;1   DEPARTMENTS.SNP;1

Total of 2 files.
$ rmu/verify/nolog mf_personnel
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1231','Testing F','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1230','Testing G','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1232','Testing H','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1233','Testing I','11111',20000,20000);
1 row inserted
commit;
```

```
insert into departments values ('1240','Testing J','11111',20000,20000);
1 row inserted
commit;
exit;
$ rmu/backup/online/nolog/incremental mf_personnel mf_personnel_inc
$ SQL
drop database filename 'mf_personnel';
exit;
$ rmu/restore/norecover/nocdd/nolog mf_personnel_full
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
$ rmu/restore/incremental/nocdd/norecover/nolog mf_personnel_inc
DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1,
 restore incrementally? [N]:Y
$ dir departments.*

Directory DEVICE:[DIRECTORY]

DEPARTMENTS.RDA;1   DEPARTMENTS.SNP;1

Total of 2 files.
$ dir [.move_db]departments.*
%DIRECT-W-NOFILES, no files found
$ rmu/verify/nolog mf_personnel
```

The following example shows the new behavior. The full database backup is done before the move of the DEPARTMENTS storage area to the new directory. When the incremental database backup is attempted after the move, the incremental backup is aborted and an error that states that a full backup should have been done after the RMU/MOVE is output.

```
$ rmu/backup/online/nolog mf_personnel mf_personnel_full
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1234','Testing A','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1235','Testing B','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1236','Testing C','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1237','Testing D','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1238','Testing E','11111',20000,20000);
1 row inserted
commit;
exit;
$ RMU/MOVE_AREA/DIRECTORY=[.move_db]/NOLOG -
  device:[directory]mf_personnel.rdb -
  DEPARTMENTS
%RMU-W-DOFULLBCK, full database backup should be done to ensure future recovery
%RMU-I-COMPLETED, MOVE_AREA operation completed at 11-OCT-2011 12:09:15.40
$ dir departments.*
%DIRECT-W-NOFILES, no files found
$ dir [.move_db]departments.*

Directory DEVICE:[DIRECTORY.MOVE_DB]

DEPARTMENTS.RDA;1   DEPARTMENTS.SNP;1
```

```
Total of 2 files.
$ rmu/verify/nolog mf_personnel
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1231','Testing F','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1230','Testing G','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1232','Testing H','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1233','Testing I','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1240','Testing J','11111',20000,20000);
1 row inserted
commit;
exit;
$ rmu/backup/online/nolog/incremental mf_personnel mf_personnel_inc
%RMU-F-NOFULLBCK, no full backup of this database exists
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 11-OCT-2011
12:30:18.08
```

The following example shows that no problems occur if the full database backup is done after the database move instead of before the database move.

```
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1234','Testing A','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1235','Testing B','11111',20000,20000);
1 row inserted
`insert into departments values ('1236','Testing C','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1237','Testing D','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1238','Testing E','11111',20000,20000);
1 row inserted
commit;
exit;
$ RMU/MOVE_AREA/DIRECTORY=[.move_db]/NOLOG -
  device:[directory]mf_personnel.rdb -
  DEPARTMENTS
%RMU-W-DOFULLBCK, full database backup should be done to ensure future recovery
%RMU-I-COMPLETED, MOVE_AREA operation completed at 11-OCT-2011 12:40:15.40
$ dir departments.*
%DIRECT-W-NOFILES, no files found
$ dir [.move_db]departments.*

Directory DEVICE:[DIRECTORY.MOVE_DB]

DEPARTMENTS.RDA;1   DEPARTMENTS.SNP;1

Total of 2 files.
$ rmu/verify/nolog mf_personnel
```

```
$ rmu/backup/online/nolog mf_personnel mf_personnel_full
$ SQL
attach 'filename mf_personnel';
insert into departments values ('1231','Testing F','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1230','Testing G','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1232','Testing H','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1233','Testing I','11111',20000,20000);
1 row inserted
commit;
insert into departments values ('1240','Testing J','11111',20000,20000);
1 row inserted
commit;
exit;
$ rmu/backup/online/nolog/incremental mf_personnel mf_personnel_inc
$ SQL
drop database filename 'mf_personnel';
exit;
$ rmu/restore/norecover/nocdd/nolog mf_personnel_full
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
$ rmu/restore/incremental/nocdd/norecover/nolog mf_personnel_inc
DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1,
 restore incrementally? [N]:Y
$ dir departments.*
%DIRECT-W-NOFILES, no files found
$ dir [.move_db]departments.*

Directory DEVICE:[DIRECTORY.MOVE_DB]

DEPARTMENTS.RDA;1   DEPARTMENTS.SNP;1

Total of 2 files.
$ rmu/verify/nolog mf_personnel
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.3.4 Parallel Incremental Backup RMU−F−NOFULLBCK Error Handling Problem

Bug 13241902

Starting with Oracle Rdb Release 7.2.5.0, the "RMU−F−NOFULLBCK" error is output if certain changes have been made to a database, such as adding a new storage area, that require a full database backup and the user attempts to execute an incremental database backup before doing a full database backup. Due to an error handling problem, for a parallel incremental backup the error message "SYSTEM−E−QUOTA" was put out in place of the "RMU−F−NOFULLBCK" error. This has been corrected and the correct "RMU−F−NOFULLBCK" error will now be output. This was only a problem with parallel incremental database backups. Non parallel database backups correctly put out the "RMU−F−NOFULLBCK" error. This was not a process quota problem but an error handling problem.

The following example shows the problem. An MF_PERSONNEL database is created and a new storage area is added to the database. When a parallel incremental database backup is done and no full database backup has been done since the new storage area was added to the database, an incorrect "SYSTEM−E−QUOTA" message is output instead of a "RMU−F−NOFULLBCK" error.

```
$ @sql$sample:personnel sql m nocdd "" []
$ SQL
alter database file mf_personnel
reserve 3 storage areas;
alter data file mf_personnel
add storage area n3;
exit
$ RMU/BACKUP/PARALLEL=(EXEC=2 ) −
/LIST_PLAN=(TEST.PLAN)/NOEXECUTE/INCLUDE=(RDB$SYSTEM, −
EMPIDS_LOW, EMPIDS_MID, EMPIDS_OVER, SALARY_HISTORY, EMP_INFO, −
DEPARTMENTS,  JOBS,     RESUMES,     RESUME_LISTS, −
N3 ) −
/noexec         −
/incremental            −
/CHECKSUM_VERIFICATION −
/DISK_file      −
MF_PERSONNEL  dev:[current_dir.BACKUP_DIR]back,dev:[current_dir.BACKUP_DIR]
$ rmu /backup /plan  test.plan
%SYSTEM−E−EXQUOTA, process quota exceeded
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at  2−NOV−2011 22:03:39.15
```

The following example shows that this problem is now fixed. An MF_PERSONNEL database is created and a new storage area is added to the database. When a parallel incremental database backup is done and no full database backup has been done since the new storage area was added to the database, the correct "RMU−F−NOFULLBCK" error is output.

```
$ @sql$sample:personnel sql m nocdd "" []
$ SQL
alter database file mf_personnel
reserve 3 storage areas;
alter data file mf_personnel
add storage area n3;
exit
$ RMU/BACKUP/PARALLEL=(EXEC=2 ) −
/LIST_PLAN=(TEST.PLAN)/NOEXECUTE/INCLUDE=(RDB$SYSTEM, −
EMPIDS_LOW, EMPIDS_MID, EMPIDS_OVER, SALARY_HISTORY, EMP_INFO, −
DEPARTMENTS,  JOBS,     RESUMES,     RESUME_LISTS, −
N3 ) −
/noexec         −
/incremental            −
/CHECKSUM_VERIFICATION −
/DISK_file      −
MF_PERSONNEL  dev:[current_dir.BACKUP_DIR]back,dev:[current_dir.BACKUP_DIR]
$ rmu /backup /plan  test.plan
%RMU−F−NOFULLBCK, no full backup of this database exists
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at  2−NOV−2011 22:10:20.10
```

To avoid getting an error, execute a full database backup after making structural changes to the database and then execute an incremental database backup. To get the correct RMU−F−NOFULLBCK error, execute a non parallel incremental database backup.

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.3.5 Problem with RMU/REPAIR/INIT=TSNS When TSNs Exceed 4,294,967,295

A problem has been discovered when using the RMU/REPAIR/INIT=TSNS command to initialize TRANSACTION SEQUENCE NUMBERS (TSNs) when the values are greater than 4,294,967,295. No error is returned by RMU, however any such TSN value stored on data or snapshot pages will not be initialized correctly. The result is that the TSN values on the database page will contain a value which is inconsistent with TSNs stored in the database root structures. TSNs contained in these database root structures are initialized correctly.

TSNs are used by the database engine for a variety of purposes. If the values on the database pages are incorrect or inconsistent, this could cause read−only transactions (or online backups) to determine that the wrong version of a record is visible. Also, an incorrect TSN could inhibit the reuse of snapshot pages, causing snapshot files to grow.

This problem was introduced in Oracle Rdb V7.0−000 and has now been fixed in Oracle Rdb Release 7.2.5.1. RMU/REPAIR/INIT=TSNS will now correctly initialize TSNs of any value. If you believe that you've been subject to this problem when using RMU/REPAIR, you should re−execute the RMU command after upgrading to this version.

6.3.6 Incorrect RMU/BACKUP/AFTER Truncate AIJ File Error Handling

Bug 13106530

When the Oracle Rdb RMU/BACKUP/AFTER command is finished backing up a single extensible After Image Journal (AIJ) file, it truncates the AIJ file to the beginning so that the AIJ file no longer contains the database transaction data written to the backup file and new data written to the AIJ file will start at the begining of the truncated AIJ file. During the database backup, transaction data can continue to be added to the extensible AIJ file before and after the truncation operation.

If a non−Rdb process accesses the extensible AIJ file during the RMU/BACKUP/AFTER truncation operation, a file access conflict can occur which will cause the AIJ backup to be aborted. There was an RMU/BACKUP/AFTER error handling problem that caused a loss of some of the transaction data being written to the AIJ file during and after the AIJ backup if a file access conflict occurred during the AIJ file truncation operation which caused the backup to be aborted. When the RMU/BACKUP/AFTER command was repeated, RMU/BACKUP/AFTER would detect at the start that the AIJ truncation operation had failed during the previous AIJ backup and immediately repeat the truncation operation. However, even though this time the truncation operation succeeded, the truncation operation was not done at the correct point and transaction data that should have been backed up was lost. This caused loss of transaction data when an RMU/RECOVER of the database was later done using the backed up AIJ files.

This problem has been fixed and now no loss of data will occur if the RMU/BACKUP/AFTER of an extensible AIJ file fails during the AIJ file truncation operation and the RMU/BACKUP/AFTER of the AIJ file is repeated once the file access conflict has been resolved or has ended. If the file truncation operation fails, it will be repeated at fixed intervals for a fixed period of time. If any of these repeated truncation operations succeeds, the AIJ backup will continue without error. If the file access conflict is of a longer duration, the RMU/BACKUP/AFTER will be aborted with a fatal file access conflict error and the invalid AIJ backup file will be deleted. Then, if the file access conflict is resolved or ends and the

RMU/BACKUP/AFTER command is repeated, a valid AIJ backup file will be created and when an RMU/RECOVER of the database is done no transaction data will be lost.

The following example shows the problem. During the first backup of the single extensible AIJ file, a file access conflict occurs on the AIJ file when the AIJ file is being truncated and the backup operation is aborted. When the file access conflict has been resolved or has ended and the AIJ backup is repeated, RMU/BACKUP/AFTER detects the truncation failure on the previous AIJ backup and repeats the AIJ file truncation. Even though this time the AIJ file truncation succeeds, the %RMU−I−EMPTYAIJ informational message shows that the truncation has not been done correctly and transaction data contained in the AIJ file has been lost.

```
$ RMU/BACKUP/AFTER/NOQUIET/LOG TESTDB ""
%RMU−I−AIJBCKBEG, beginning after−image journal backup operation
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation started
%RMU−I−AIJBCKSEQ, backing up after−image journal sequence number 0
%RMU−I−LOGBCKAIJ, backing up after−image journal AIJ_1 at 05:28:23.11
%RMU−I−LOGCREBCK, created backup file
            DEVICE:[DIRECTORY]AIJ_1_BCK0_18102011.AIJ;1
%RMU−I−LOGAIJBCK, backed up 3 committed transactions at 05:28:50.92
%RMU−I−AIJMODSEQ, next AIJ file sequence number will be 1
%RMU−I−AIJBCKSTOP, backup of after−image journal AIJ_1 did not complete
%RMU−I−OPERNOTIFY, system operator notification: AIJ manual backup
      operation failed
%RMU−F−FILACCERR, error truncating file
−SYSTEM−W−ACCONFLICT, file access conflict
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 18−OCT−2011 05:28:50.93
$
$ RMU/BACKUP/AFTER/NOQUIET/LOG TESTDB ""
%RMU−I−AIJBCKBEG, beginning after−image journal backup operation
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation started
%RMU−I−AIJBCKSEQ, backing up after−image journal sequence number 1
%RMU−I−LOGBCKAIJ, backing up after−image journal AIJ_1 at 05:32:33.21
 the %RMU−W−BADAIJBCK, previous AIJ backup did not complete
%RMU−I−EMPTYAIJ, after−image journal file is empty
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup
          operation completed
%RMU−I−AIJBCKEND, after−image journal backup operation completed successfully
```

The following example shows that this problem has been fixed. On the first AIJ backup, the file access conflict occurs during the backup truncation operation but it is of short duration so when the new retry logic repeats the truncation operation it succeeds and the AIJ backup completes normally without any loss of AIJ transaction data. On the second AIJ backup, the file access conflict again occurs when the AIJ file is being truncated but it is of longer duration so the repeated retries of the truncation operation all fail, the backup has to be aborted and the invalid AIJ backup file is deleted. When the third AIJ backup is done, the file access conflict does not occur. The third AIJ backup detects that the previous AIJ backup failed but now the backup file truncation operation is done correctly, the backup operation is successful and a valid AIJ backup file is created.

```
$ RMU/BACKUP/AFTER/NOQUIET/LOG TESTDB ""
%RMU−I−AIJBCKBEG, beginning after−image journal backup operation
%RMU−I−OPERNOTIFY, system operator notification: AIJ backup operation
started
%RMU−I−AIJBCKSEQ, backing up after−image journal sequence number 0
%RMU−I−LOGBCKAIJ, backing up after−image journal AIJ_1 at 09:20:11.12
%RMU−I−LOGCREBCK, created backup file
DEVICE:[DIRECTORY]AIJ_1_BCK0_08122011.AIJ;1
%RMU−I−LOGAIJBCK, backed up 3 committed transactions at 09:20:18.63
```

```
%RMU-I-AIJMODSEQ, next AIJ file sequence number will be 1
%RMU-I-OPERNOTIFY, system operator notification: AIJ backup operation
completed
%RMU-I-AIJBCKEND, after-image journal backup operation completed
successfully
%RMU-I-LOGAIJJRN, backed up 1 after-image journal at 09:20:29.03
%RMU-I-LOGAIJBLK, backed up 415615 after-image journal blocks at
09:20:29.03
%RMU-I-LOGAIJBCK, backed up 3 committed transactions at 09:20:29.03
$
$ RMU/BACKUP/AFTER/NOQUIET/LOG TESTDB ""
%RMU-I-AIJBCKBEG, beginning after-image journal backup operation
%RMU-I-OPERNOTIFY, system operator notification: AIJ backup operation
started
%RMU-I-AIJBCKSEQ, backing up after-image journal sequence number 0
%RMU-I-LOGBCKAIJ, backing up after-image journal AIJ_1 at 09:59:02.02
%RMU-I-LOGCREBCK, created backup file
DEVICE:[DIRECTORY]AIJ_1_BCK0_08122011.AIJ;1
%RMU-I-LOGAIJBCK, backed up 3 committed transactions at 09:59:09.96
%RMU-W-DELBCKFIL, backup aborted, deleting backup file
DEVICE:[DIRECTORY]AIJ_1_BCK0_08122011.AIJ;1
%RMU-I-LOGDELFIL, deleted file
DEVICE:[DIRECTORY]AIJ_1_BCK0_08122011.AIJ;1
%RMU-I-AIJBCKSTOP, backup of after-image journal AIJ_1 did not
complete
%RMU-I-OPERNOTIFY, system operator notification: AIJ manual backup
operation failed
%RMU-F-FILACCERR, error truncating after-image journal file
-SYSTEM-W-ACCONFLICT, file access conflict
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at  8-DEC-2011
09:59:10.13
$
$ RMU/BACKUP/AFTER/NOQUIET/LOG TESTDB ""
%RMU-I-AIJBCKBEG, beginning after-image journal backup operation
%RMU-I-OPERNOTIFY, system operator notification: AIJ backup operation
started
%RMU-I-AIJBCKSEQ, backing up after-image journal sequence number 0
%RMU-I-LOGBCKAIJ, backing up after-image journal AIJ_1 at 10:16:41.55
%RMU-W-BADAIJBCK, previous AIJ backup did not complete
%RMU-I-LOGCREBCK, created backup file
DEVICE:[DIRECTORY]AIJ_1_BCK0_08122011.AIJ;1
%RMU-I-LOGAIJBCK, backed up 4 committed transactions at 10:16:50.44
%RMU-I-AIJMODSEQ, next AIJ file sequence number will be 1
%RMU-I-OPERNOTIFY, system operator notification: AIJ backup operation
completed
%RMU-I-AIJBCKEND, after-image journal backup operation completed
successfully
%RMU-I-LOGAIJJRN, backed up 1 after-image journal at 10:16:51.01
%RMU-I-LOGAIJBLK, backed up 559815 after-image journal blocks at
10:16:51.01
%RMU-I-LOGAIJBCK, backed up 4 committed transactions at 10:16:51.01
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.3.7 Unexpected RMU-W-DATNOTIDX Reported by RMU Verify for Rdb$WORKLOAD Table

In prior releases of Oracle Rdb, it was possible to have rows inserted into Rdb$WORKLOAD that had no matching index entries. This may occur if WORKLOAD COLLECTION IS ENABLED and multiple

duplicate workload rows are inserted by different concurrent processes.

In general, this is harmless to the functioning of the database and the usage of WORKLOAD data. However, RMU/VERIFY may report errors similar to the following:

```
%RMU-W-DATNOTIDX, Row in table RDB$WORKLOAD is not in any indexes.
                  Logical dbkey is 60:296:24.
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. The INSERT of the Rdb$WORKLOAD rows has been corrected so that this error no longer occurs. However, if these duplicate rows already exist then they can be removed using the following process.

1. Save the existing Rdb$WORKLOAD rows.

   ```
   $ RMU/EXTRACT/ITEM=WORKLOAD/OUT=WRKLD.COM MYDATABASE
   ```

2. Truncate the Rdb$WORKLOAD table.

   ```
   SQL> attach 'filename MYDATABASE';
   SQL> truncate table Rdb$WORKLOAD;
   SQL> commit;
   ```

   Note

   This requires Oracle Rdb Release 7.2.5.1 or later which supports using TRUNCATE TABLE for this system table Rdb$WORKLOAD.

   ---

3. Finally execute the extract .COM file (WRKLD.COM in this example) to re-add the older definitions.

   ```
   $ @WRKLD.COM
   ```

6.4 LogMiner Errors Fixed

6.4.1 RMU/UNLOAD/AFTER_JOURNAL SYSTEM−W−ENDOFFILE Error on a Work File

Bug 12646877

When extracting large database transactions, the Oracle Rdb RMU/UNLOAD/AFTER_JOURNAL command creates temporary work files. There was a problem managing the buffer pools used with these work files which could cause a SYSTEM−W−ENDOFFILE error to occur when reading a work file when multiple database tables were being unloaded in the same RMU/UNLOAD/AFTER_JOURNAL command. This error would cause the command to abort the unload operation.

```
%RMU−F−FILACCERR, error reading work file
DEVICE:[DIRECTORY]U2J4IN470PA101HE0280.TMP;1
−SYSTEM−W−ENDOFFILE, end of file
%RMU−F−FTL_RMU, Fatal error for RMU operation at 7−JUL−2011 14:18:19.67
```

This problem has been fixed. The workaround for this problem in earlier versions of Oracle Rdb is to not unload all the database tables in the same RMU/UNLOAD/AFTER_JOURNAL command.

The following example shows the problem and the workaround. The problem occurs when three tables are unloaded in the same RMU/UNLOAD/AFTER_JOURNAL command. The problem does not happen if two tables are unloaded in one RMU/UNLOAD/AFTER_JOURNAL command and one table is unloaded in a second RMU/UNLOAD/AFTER_JOURNAL command. Three RMU/UNLOAD/AFTER_JOURNAL commands, each unloading one table, could also have been used as a workaround.

```
$ RMU/UNLOAD/AFTER_JOURNAL/INCL=ACT=(NOCOMMIT)/STAT=1800 −
/RESTORE_METADATA=TESTRDB_MULTI.METADATA −
/table=(name=T1,output=rdb_logminer_output_file) −
/table=(name=T2,output=rdb_logminer_output_file) −
/table=(name=T3,output=rdb_logminer_output_file) −
/restart=1−28−1−161750−25853−25853 /log −
TESTRDB_MULTI.RDB TESTRDB_PDE.AIJ
%RMU−I−LMMFRDCNT, Read 427 objects from metadata file
"DEVICE:[DIRECTORY]TESTRDB_MULTI.METADATA;1"
%RMU−I−UNLAIJFL, Unloading table T1 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;57
%RMU−I−UNLAIJFL, Unloading table T2 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;57
%RMU−I−UNLAIJFL, Unloading table T3 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;57
%RMU−I−LOGOPNAIJ, opened journal file
DEVICE:[DIRECTORY]TESTRDB_PDE.AIJ;1 at  7−JUL−2011 14:18:18.58
%RMU−I−AIJRSTSEQ, journal sequence number is "1"
%RMU−F−FILACCERR, error reading work file
DEVICE:[DIRECTORY]U2J4IN470PA101HE0280.TMP;1
−SYSTEM−W−ENDOFFILE, end of file
%RMU−F−FTL_RMU, Fatal error for RMU operation at  7−JUL−2011 14:18:19.67
$ RMU/UNLOAD/AFTER_JOURNAL/INCL=ACT=(COMMIT)/STAT=1800 −
/RESTORE_METADATA=TESTRDB_MULTI.METADATA −
/table=(name=T1,output=rdb_logminer_output_file) −
/table=(name=T3,output=rdb_logminer_output_file) −
/restart=1−28−1−161750−25853−25853 /log −
```

```
TESTRDB_MULTI.RDB TESTRDB_PDE.AIJ
%RMU-I-LMMFRDCNT, Read 427 objects from metadata file
"DEVICE:[DIRECTORY]TESTRDB_MULTI.METADATA;1"
%RMU-I-UNLAIJFL, Unloading table T1 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;58
%RMU-I-UNLAIJFL, Unloading table T3 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;58
%RMU-I-LOGOPNAIJ, opened journal file
DEVICE:[DIRECTORY]TESTRDB_PDE.AIJ;1 at  7-JUL-2011 14:19:23.36
%RMU-I-AIJRSTSEQ, journal sequence number is "1"
%RMU-I-AIJMODSEQ, next AIJ file sequence number will be 2
%RMU-I-LOGSUMMARY, total 6299 transactions committed
%RMU-I-LOGSUMMARY, total 0 transactions rolled back
$ RMU/UNLOAD/AFTER_JOURNAL/INCL=ACT=(COMMIT)/STAT=1800 -
/RESTORE_METADATA=TESTRDB_MULTI.METADATA -
/table=(name=T2,output=rdb_logminer_output_file) -
/restart=1-28-1-161750-25853-25853 /log -
TESTRDB_MULTI.RDB TESTRDB_PDE.AIJ
%RMU-I-LMMFRDCNT, Read 427 objects from metadata file
"DEVICE:[DIRECTORY]TESTRDB_MULTI.METADATA;1"
%RMU-I-UNLAIJFL, Unloading table T2 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;59
%RMU-I-LOGOPNAIJ, opened journal file
DEVICE:[DIRECTORY]TESTRDB_PDE.AIJ;1 at  7-JUL-2011 14:20:31.30
%RMU-I-AIJRSTSEQ, journal sequence number is "1"
%RMU-I-AIJMODSEQ, next AIJ file sequence number will be 2
%RMU-I-LOGSUMMARY, total 6299 transactions committed
%RMU-I-LOGSUMMARY, total 0 transactions rolled back
```

The following example shows that this problem has been fixed. Now all the tables can be unloaded in the same RMU/UNLOAD/AFTER_JOURNAL command and the command completes with no error.

```
$ RMU/UNLOAD/AFTER_JOURNAL/INCL=ACT=(NOCOMMIT)/STAT=1800 -
/RESTORE_METADATA=TESTRDB_MULTI.METADATA -
/table=(name=T1,output=rdb_logminer_output_file) -
/table=(name=T2,output=rdb_logminer_output_file) -
/table=(name=T3,output=rdb_logminer_output_file) -
/restart=1-28-1-161750-25853-25853 /log -
TESTRDB_MULTI.RDB TESTRDB_PDE.AIJ
%RMU-I-LMMFRDCNT, Read 427 objects from metadata file
"DEVICE:[DIRECTORY]TESTRDB_MULTI.METADATA;1"
%RMU-I-UNLAIJFL, Unloading table T1 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;56
%RMU-I-UNLAIJFL, Unloading table T2 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;56
%RMU-I-UNLAIJFL, Unloading table T3 to
DEVICE:[DIRECTORY]RDB_LOGMINER_OUTPUT_FILE.DAT;56
%RMU-I-LOGOPNAIJ, opened journal file
DEVICE:[DIRECTORY]TESTRDB_PDE.AIJ;1 at  7-JUL-2011 14:15:47.64
%RMU-I-AIJRSTSEQ, journal sequence number is "1"
%RMU-I-AIJMODSEQ, next AIJ file sequence number will be 2
%RMU-I-LOGSUMMARY, total 6299 transactions committed
%RMU-I-LOGSUMMARY, total 0 transactions rolled back
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.5 RMU Show Statistics Errors Fixed

6.5.1 RMU/SHOW STATISTICS Configuration File Problems in Oracle Rdb Release 7.2.5.0

Bugs 12710800 and 12710931

The Oracle Rdb RMU/SHOW STATISTICS implementation for Configuration File support did not work correctly in Oracle Rdb Release 7.2.5.0. This problem did not affect other RMU/SHOW STATISTICS functions, just the functions related to the Configuration File. The workaround for this problem is not to use the Configuration File with RMU/SHOW STATISTICS for Release 7.2.5.0 but to use the equivalent command line qualifiers if they exist.

The following shows two such Oracle Rdb Release 7.2.5.0 RMU/SHOW STATISTICS Configuration File problems. In Oracle Rdb Release 7.2.5.0, when the RMU/SHOW STATISTICS command is invoked with a Configuration File, CONFIGURE.CFG, which specifies that a stall log file, a timeout log file, and a deadlock log file are to be created, an access violation occurs, the command is aborted and no log files are created. In the second example, when the RMU/SHOW STATISTICS command is executed a second time and the command "!A" is executed specifying that the current RMU/SHOW STATISTICS configuration is to be saved to the Configuration File, CONFIGURE2.CFG, another access violation occurs and the command is also aborted.

```
$ RMU/SHOW VERSION
Executing RMU for Oracle Rdb V7.2−500 on OpenVMS Alpha V8.3−V84
$ CREATE CONFIGURE.CFG
STALL_LOG = "a.log";
TIMEOUT_LOG = "b.log";
DEADLOCK_LOG = "c.log";
$ RMU /SHOW STATISTICS /INTERACTIVE MF_PERSONNEL −
        /CONFIGURE=CONFIGURE.CFG
%SYSTEM−F−ACCVIO, access violation, reason mask=00,
 virtual address=000000000000001D, PC=0000000000342A80, PS=0000001B
%RMU−F−FATALOSI, Fatal error from the Operating System Interface.
%RMU−I−BUGCHKDMP, generating bugcheck dump file DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU−F−FTL_SHOW, Fatal error for SHOW operation at 18−JUL−2011 16:21:37.94
$ DIR *.LOG

%DIRECT−W−NOFILES, no files found
$ RMU/SHOW STATISTICS/INTERACTIVE MF_PERSONNEL
!
A
CONFIGURE2.CFG
%SYSTEM−F−ACCVIO, access violation, reason mask=04,
 virtual address=000000007AA52000, PC=FFFFFFFF81111328, PS=0000001B

  Improperly handled condition, image exit forced by last chance handler.
    Signal arguments:   Number = 0000000000000005
                        Name   = 000000000000000C
                                 0000000000000004
                                 000000007AA52000
                                 FFFFFFFF81111328
                                 000000000000001B

    Register dump:
```

```
    R0  = 000000007AA4B913  R1  = FFFFFFFF813E4E2C  R2  = 000000007BE78408
    R3  = 000000007AA4B8F0  R4  = 0000000000000023  R5  = 0000000022203D20
    R6  = 00000000000E0000  R7  = 0000000000003B22  R8  = 0000000001000000
    R9  = 00000000010E00FF  R10 = 00000000000F8B18  R11 = 00000000001DA1E8
    R12 = 00000000056EC0D4  R13 = 0000000001000000  R14 = 0000000000136498
    R15 = 00000000001CF610  R16 = 000000007AA520D8  R17 = 00000000434EDFF3
    R18 = 0000000000000000  R19 = 0000000000000000  R20 = 0000000000000003
    R21 = 000000007AA4B8F0  R22 = 0000000000000000  R23 = 000000007AA4B7B0
    R24 = 00000000000183B2  R25 = 0000000000000003  R26 = FFFFFFFF813687C4
    R27 = 0000000000000000  R28 = 000000007AA520D8  R29 = 000000007BE6BC00
    SP  = 000000007AA4B7B0  PC  = FFFFFFFF81111328  PS  = 300000000000001B
```

The following example shows that the two Oracle Rdb Release 7.2.5.0 RMU/SHOW STATISTICS Configuration File problems described in the previous example have been fixed. In the first command, the three log files specified by the Configutation File are created and then written to during the RMU/SHOW STATISTICS session. In the second command, a new Configuration File is created containing the current RMU/SHOW STATISTICS configuration.

```
$ CREATE CONFIGURE.CFG
STALL_LOG = "a.log";
TIMEOUT_LOG = "b.log";
DEADLOCK_LOG = "c.log";
$ RMU /SHOW STATISTICS /INTERACTIVE MF_PERSONNEL -
        /CONFIGURE=CONFIGURE.CFG
%RMU-I-LOGCREOUT, created output file DEVICE:[DIRECTORY]A.LOG;1
%RMU-I-LOGCREOUT, created output file DEVICE:[DIRECTORY]B.LOG;1
%RMU-I-LOGCREOUT, created output file DEVICE:[DIRECTORY]C.LOG;1
$ DIR *.LOG

Directory DEVICE:[DIRECTORY]

A.LOG;1             B.LOG;1             C.LOG;1

Total of 3 files.
$ RMU/SHOW STATISTICS/INTERACTIVE MF_PERSONNEL
!
A
CONFIGURE2.CFG

$ DIR CONFIGURE2.CFG

Directory DEVICE:[DIRECTORY]

CONFIGURE2.CFG;1

Total of 1 file.
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.5.2 RMU/SHOW STATISTICS Release 7.2.5.0 Hot Row Information Screen %SYSTEM-F-ACCVIO

The Oracle Rdb RMU/SHOW STATISTICS Row Cache "Hot Row Information" display screen access violates in Oracle Rdb Release 7.2.5.0. This problem does not affect other RMU/SHOW STATISTICS functions. There is no workaround for this problem.

The following shows the problem. In Oracle Rdb Release 7.2.5.0, when the RMU/SHOW STATISTICS command Row Cache "Hot Row Information" display screen is invoked, a %SYSTEM−F−ACCVIO access violation occurs and an RMUBUGCHK.DMP is created with the stack trace displayed.

```
$ RMU/SHOW VERSION
Executing RMU for Oracle Rdb V7.2−500 on OpenVMS Alpha V8.3−V84
$ RMU/SHOW STATISTICS FOO.RDB

Node: NODE01 (1/1/1)    Oracle Rdb V7.2−500 Perf. Monitor 9−AUG−2011 11:27:09.19
Rate: 3.00 Seconds       Row Cache Overview (Unsorted)      Elapsed: 00:01:36.26
Page: 1 of 1          DEVICE:[DIRECTORY]FOO.RDB;1           Mode: Online

Cache.Name.............  #Searches  Hit% Full%  #Inserts #Wrap    #Slots   Len
RDB$SYSTEM_CACHE                  0   0.0   0.0         0     0       500  1000


%SYSTEM−F−ACCVIO, access violation, reason mask=04,
 virtual address=FFFFFFFF800000F0, PC=000000000072F834, PS=0000001B
%RMU−F−FATALOSI, Fatal error from the Operating System Interface.
%RMU−I−BUGCHKDMP, generating bugcheck dump file
DEVICE:[DIRECTORY]RMUBUGCHK.DMP;
%RMU−F−FTL_SHOW, Fatal error for SHOW operation at  9−AUG−2011
11:27:33.56
$ type DEVICE:[DIRECTORY]RMUBUGCHK.DMP

This file was generated by Oracle Rdb V7.2−500 upon detection of a
fatal, unexpected, error.  Please return this file, the query or
program that produced the bugcheck, the database, monitor log, and any
other pertinent information to your Oracle support representative for
assistance.

================================================================================
        Stack Dump Summary
================================================================================

***** Exception at 000000000072F834 : RMU72\KUTDIS$SETUP_RCD_ACTRTN + 000001F4
%SYSTEM−F−ACCVIO, access violation, reason mask=04,
 virtual address=FFFFFFFF800000F0, PC=000000000072F834, PS=0000001B
Saved PC = 000000000066F4C4 : RMU72\KUTDIS$SETUP_COMMON + 00000144
Saved PC = 000000000065B184 : RMU72\KUTDIS$BATCH_SETUP_COMMON + 00000084
Saved PC = 00000000006672A4 : RMU72\KUTDIS$MAIN_MENU_ACTIONS + 000002B4
Saved PC = 000000000065E3E4 : RMU72\KUTDIS$DO_UNSOLICITED_INPUT + 000002B4
Saved PC = 00000000006E3308 : RMU72\KUTDIS$UNSOLICITED_INPUT_ASTX + 000000D8
Saved PC = 000000000065D694 : RMU72\KUTDIS$DISPATCH + 000000A4
Saved PC = 0000000000656344 : RMU72\KUT$DISPLAY + 00001D04
Saved PC = 00000000005B2E78 : RMU72\RMU$DISPLAY + 000036B8
Saved PC = 00000000001FF50C : RMU72\RMU$SHOW + 00000ECC
Saved PC = 00000000003DE45C : RMU72\RMU_DISPATCH + 000013BC
Saved PC = 00000000003DCC6C : RMU72\RMU_STARTUP + 000004FC
Saved PC = 00000000001F0F24 : RMU72\RMU$MAIN + 00000034
Saved PC = 000000007AECF5D8 : Image DCL + 000935D8
```

The following example shows that this problem has been fixed and the RMU/SHOW STATISTICS Row Cache "Hot Row Information" screen is now displayed correctly.

```
$ RMU/SHOW STATISCTICS FOO.RDB

Node: NODE01 (1/1/1)    Oracle Rdb V7.2−510 Perf. Monitor  9−AUG−2011
 11:20:20.64
Rate: 3.00 Seconds            Hot Row Information           Elapsed: 00:04:34.18
```

```
Page:  1 of 16        DEVICE:[DIRECTORY]FOO.RDB;1          Mode: Online

                     For Cache: RDB$SYSTEM_CACHE (unsorted)
Area:Page:Ln #Users State Length SlotNo Area:Page:Ln #Users State Length SlotNo
Empty             0            0      0 Empty             0            0     16
Empty             0            0      1 Empty             0            0     17
Empty             0            0      2 Empty             0            0     18
Empty             0            0      3 Empty             0            0     19
Empty             0            0      4 Empty             0            0     20
Empty             0            0      5 Empty             0            0     21
Empty             0            0      6 Empty             0            0     22
Empty             0            0      7 Empty             0            0     23
Empty             0            0      8 Empty             0            0     24
Empty             0            0      9 Empty             0            0     25
Empty             0            0     10 Empty             0            0     26
Empty             0            0     11 Empty             0            0     27
Empty             0            0     12 Empty             0            0     28
Empty             0            0     13 Empty             0            0     29
Empty             0            0     14 Empty             0            0     30
Empty             0            0     15 Empty             0            0     31

Config Exit Help Menu >next_page <prev_page ]next_obj [prev_obj Options Set_rate
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1.

6.5.3 Unexpected Failure in COSI_MEM_FREE_VMLIST When Using RMU Show Statistics

Bug 9853784

In prior versions of Oracle Rdb, the RMU Show Statistics command may abort with a bugcheck similar to the following footprint.

- Itanium OpenVMS 8.3−1H1
- Oracle Rdb Server 7.2.4.1.0
- Got a RMUBUGCHK.DMP
- SYSTEM−F−ACCVIO, access violation, virtual address=0000000034383030
- Exception occurred at RMU72\COSI_MEM_FREE_VMLIST + 00000132
- Called from RMU72\KUTDIS$TOOLS_CONTROL + 00010170
- Called from RMU72\KUTDIS$TOOLS_MENU + 0000DBC0
- Called from RMU72\KUTDIS$MAIN_MENU_ACTIONS + 000032D0
- Running image RMU72.EXE
- Command line was: RMUI/SHOW STAT MF_PERSONNEL

This occurs when the list of process ID's listed by SHOW STATISTICS exceeds an internal buffer (approximately 144 entries).

For instance, when entering this sequence of commands on the problem system, RMU wanted to display a list of 200 PID values.

- !
- R (<<more>>)
- J (Process monitoring)
- B (Activate specific eligible process)

- When prompted answer with "?" to get a full list of process ids.

Note

Actual menu selections may differ depending on the Rdb version being used.

This problem has been corrected in Oracle Rdb Release 7.2.5.1. RMU SHOW STATS now dynamically allocates the list to accommodate a virtually unlimited list of process ID's.

6.5.4 Invalid Average Transaction Duration Value Displayed When Using RMU Show Statistics

Bug 13017360

With Oracle Rdb Release 7.2.5, the Oracle Rdb RMU Show Statistics "Transaction Duration" screen displayed an incorrect average transaction duration value.

The command to see that statistics screen is:

```
$ RMU/SHOW STATISTICS MF_PERSONNEL/SCREEN="Transaction Duration (Total)"
```

In most cases, RMU SHOW STATS would only display "<−avg=0.000000". The value displayed was 1/10,000th of the true value, leading to a much smaller number than the actual value.

This problem has been corrected in Oracle Rdb Release 7.2.5.1. RMU SHOW STATS now shows the correct statistics for the average transaction duration.

6.5.5 RMU Show Statistics Sometimes Bugchecks When Using Process Monitoring

Bug 13070947

The Oracle Rdb RMU Show Statistics command "Process monitoring" option would sometimes bugcheck. The following sequence of commands, while in an RMU/SHOW STATISTICS window, would sometimes result in a bugcheck.

```
 ! (to get to the Select Tool)
 R. <<more>>
 J. Process monitoring
 B. Activate specific eligible process
 Enter process ID to "activate" (or "?"): (enter id here)

 ! (to get to the Select Tool)
 J. Process monitoring
 A. Select activated process to monitor
 Process detached; Continue reviewing? ("Yes" to continue, "RETURN" to cancel)
```

The bugcheck looked like the following:

```
***** Exception at FFFFFFFF84230400 : Image LIBOTS + 00002400
%SYSTEM−F−ACCVIO, access violation, reason mask=00,
```

```
virtual address=0000000003A64000, PC=FFFFFFFF84230400, PS=0000001B
Saved PC = 000000008089AB10 : RMU72\KUTDIS$TOOLS_CONTROL + 0000EE80
Saved PC = 00000000809855A0 : RMU72\KUTDIS$TOOLS_MENU + 0000DBC0
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. RMU will no longer bugcheck and will show the requested statistics.

6.5.6 RMU Show Statistics Sometimes Bugchecks on Row Cache Information Screen

Bug 13558012

The Oracle Rdb RMU Show Statistics command "Hot Row Information" option would sometimes bugcheck. The following sequence of commands, while in an RMU/SHOW STATISTICS window, would sometimes result in a bugcheck when monitoring row cache.

```
 M (Menu)
 X (Row Cache Information)
 B (Hot Row Information)
 Select one cache
```

The bugcheck had the following footprint:

```
SYSTEM-F-ACCVIO, access violation, virtual address=FFFFFFFF817B80B0
Exception occurred at RMU72\KUTDIS$SETUP_RCD_ACTRTN + 00000460
```

This problem has been corrected in Oracle Rdb Release 7.2.5.1. RMU will no longer bugcheck and will show the requested statistics.

Chapter 7
Software Errors Fixed in Oracle Rdb Release 7.2.5

This chapter describes software errors that are fixed by Oracle Rdb Release 7.2.5.

7.1 Software Errors Fixed That Apply to All Interfaces

7.1.1 Server Process Name Format Changed

When starting server processes (such as database recovery processes), previous releases of Oracle Rdb would always start creating processes with a name starting with a number one (such as RDM_RDB72_1). In some cases, when starting a large number of processes or when multiple databases were opened on a system, duplicate names would be created and processes would have to be re−started with a different process name. This resulted in additional system resources being consumed.

This problem has been reduced in Oracle Rdb Release 7.2.5. Server processes are created with much more unique names.

7.1.2 Drop Storage Area Cascade Failed With Lock On Unrelated Area

Bug 7496558

When dropping a storage area using the CASCADE option, a lock on an unrelated area could have caused the drop to fail.

For example, if an RMU/UNLOAD was running which referenced storage areas unrelated to the target area of the ALTER DATABASE ... DROP STORAGE AREA ... CASCADE statement, a LOCK_CONFLICT error was reported.

```
SQL> ALTER DATABASE FILENAME DDLLOCK DROP STORAGE AREA T5 CASCADE;
%RDB−E−LOCK_CONFLICT, request failed due to locked resource
−RDMS−F−LCKCNFLCT, lock conflict on client 'DDL' 4C444400000055
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.3 Temporary File Names

Oracle Rdb generates random file names for various temporary functions (such as AIJ recovery work files). In rare cases, the file names would not be unique in a cluster and could potentially cause a conflict.

This problem has been corrected in Oracle Rdb Release 7.2.5. Oracle Rdb now generates file names that are unique within a cluster.

7.1.4 Incorrect Storage Area Selected In Cluster

Bug 9629294

In an environment where a database is opened on multiple nodes of a cluster, it is possible that certain combinations of dropping and adding storage areas online with storage area names being re−used may result

in storage map creation selecting an incorrect area.

The following command sequence on two nodes of a cluster shows one possible case where a table is incorrectly mapped to a storage area not specified. Note that the final "RMU/ANALYZE/AREA=A2 TESTDB" command output shows both tables T1 and T2 being unexpectedly stored in area A2 even though the storage map has specified area A1 for table T1.

```
        NODEA                           NODEB
------------------------------ ------------------------------------
$ SQL$
 CREATE DATABASE FILE TESTDB
 OPEN IS MANUAL
 RESERVE 10 STORAGE AREAS
 CREATE STORAGE AREA DUMMY;
 EXIT
$ RMU /OPEN TESTDB

                                $ RMU /OPEN TESTDB
                                $ SQL$
                                 ALTER DATABASE FILE TESTDB
                                 ADD STORAGE AREA A1
                                 ADD STORAGE AREA A2;
                                 ATTACH 'FILE TESTDB';
                                 CREATE TABLE T1 ( I1 INT );
                                 CREATE STORAGE MAP M1
                                        FOR T1 STORE IN A1;
                                 CREATE TABLE T2 ( I1 INT );
                                 CREATE STORAGE MAP M2
                                        FOR T2 STORE IN A2;
                                 COMMIT;
                                 EXIT
                                $ RMU /CLOSE TESTDB

$ RMU/CLOSE TESTDB

                                $ RMU/OPEN TESTDB

$ RMU /OPEN TESTDB
$ SQL$
 ATTACH 'FILE TESTDB';
 DROP TABLE T1;
 DROP TABLE T2;
 COMMIT;

                                $ SQL$
                                 ALTER DATABASE FILE TESTDB
                                        DROP STORAGE AREA A1
                                        DROP STORAGE AREA A2;
                                 ALTER DATABASE FILE TESTDB
                                        ADD STORAGE AREA A2;
                                 ALTER DATABASE FILE TESTDB
                                        ADD STORAGE AREA A1;
                                 EXIT

 CREATE TABLE T1 ( I1 INT );
 CREATE STORAGE MAP M1
        FOR T1 STORE IN A1;
 CREATE TABLE T2 ( I1 INT );
 CREATE STORAGE MAP M2
        FOR T2 STORE IN A2;
 COMMIT;
```

```
 EXIT

$ RMU/ANALYZE/AREA=A2 TESTDB
... Both tables are stored in A2
```

This problem was caused by a failure to invalidate a cache of storage area names during a search for a matching name. Because the cache was stale, an incorrect storage area slot was selected.

This problem has been corrected in Oracle Rdb Release 7.2.5. The internal cache of storage area names is now correctly synchronized in a cluster environment.

7.1.5 Unexpected SYSTEM−F−VA_NOTPAGALGN Error With Global Buffers and Reserved Memory Registry

Bug 8204438

In some cases, when using database global buffers along with a resident database global section along with the global section being allocated via the OpenVMS Reserved Memory Registry, opening the database may fail with the error SYSTEM−F−VA_NOTPAGALGN as in the following example:

```
$ RMU/OPEN FOO/GLOBAL_BUFFERS=TOTAL=1231
%RDMS−F−CANTOPENDB, database could not be opened as requested
−RDMS−F−CANTCREGBL, error creating and mapping database global section
−SYSTEM−F−VA_NOTPAGALGN, specified virtual address is not CPU−specific page
aligned
```

This problem has been corrected in Oracle Rdb Release 7.2.5. As a workaround if this problem is encountered, the memory reservation for the database global section can be removed as in the following example:

```
$ MCR SYSMAN RESERVED_MEMORY FREE RDM72N$1$DGA242296000400000000000
%SMI−S−RMRFREPAG, pages successfully freed from reservation
$ RMU/OPEN FOO/GLOBAL_BUFFERS=TOTAL=1231
```

7.1.6 Unexpected Bugcheck at RDMS$$PARSE_INTCOM_BUFFER Which Reports "Obsolete Version of Database"

Bugs 460614, 3314889, 3655192, 3658460, 6988338, 8271388, 8616430, 8785676, 9206054 and 9887582

In prior releases of Oracle Rdb, it was possible in rare circumstances to have a bugcheck generated similar to that shown below. This problem occurred during database attach and was due to a timing issue related to asynchonous database events.

- Itanium OpenVMS 8.3−1H1
- Oracle Rdb Server 7.2.3.1.0
- Got a RDSBUGCHK.DMP
- RDB−F−WRONGRDB, RDB$SHARE image is wrong
- RDMS−F−OBSVER, obsolete version of database

- Exception occurred at RDMSHRP72\RDMS$$PARSE_INTCOM_BUFFER + 00000740
- Called from RDMSHRP72\KODSTREAM$JACKET + 00000100
- Called from symbol not found
- Called from RDMSHRP72\KOD$SETSTK_AND_CONTINUE + 00000180

This problem has been corrected in Oracle Rdb Release 7.2.4.2 for the ATTACH, CONNECT and DECLARE ALIAS statements. This release, 7.2.5, also corrects other areas for DISCONNECT, SET SESSION AUTHORIZATION, DROP DATABASE, and ALTER DATABASE.

7.1.7 RDBPRE Precompiler RUNTIMSTK Informational Message From MACRO Compiler

In some cases, the RDBPRE Precompiler may create code that causes the MACRO−32 Compiler for OpenVMS I64 and the MACRO−32 Compiler for OpenVMS Alpha to display an informational message similar to "%IMAC−I−RUNTIMSTK, run time stack differences prevent accurate stack tracing". This informational message can be safely ignored.

Consider the following example program:

```
PROGRAM−ID. x.
DATA DIVISION.
WORKING−STORAGE SECTION.

&RDB& INVOKE DATABASE EXTERNAL d1 = FILENAME "PERSONNEL"
&RDB& INVOKE DATABASE EXTERNAL d2 = FILENAME "PERSONNEL"

PROCEDURE DIVISION.
01−INITIALIZE−AND−PROCESS.
&RDB&   FINISH
        DISPLAY "Hello World".
        EXIT PROGRAM.

END PROGRAM x.
```

During compilation, the "RUNTIMSTK" informational message is displayed:

```
$ RDBPRE /COBOL X.RCO

3$:
^
%IMAC−I−RUNTIMSTK, run time stack differences prevent accurate
stack tracing at line number 214 in file DUA0:[RDB73]X.MAR;1
```

This issue has been corrected in Oracle Rdb Release 7.2.5. The generated code for the FINISH section has been modified to avoid the "RUNTIMSTK" informational message.

7.1.8 Bugcheck At RUJUTL$ROLLBACK_LOOP

Bug 9856675

In very rare cases, it is possible for a rollback operation (either explicit or implicit) to fail with a bugcheck due to entries being unable to be "undone" on a database page due to an unexpected lack of "locked" space. The sequence of events is complex and requires a specific ordering of operations and accumulation of locked and

free space on a database page among several processes.

The bugcheck "footprint" will be similar to the following:

```
Exception occurred at RDMSHRP72\RUJUTL$ROLLBACK_LOOP + 000010A1
Called from RDMSHRP72\RUJ$ROLLBACK + 000000F0
Called from RDMSHRP72\KOD$ROLLBACK + 000007A0
Called from RDMSHRP72\RDMS$$INT_ROLLBACK_TRANSACTION + 00001140
Called from RDMSHRP72\RDMS$TOP_ROLLBACK_TRANSACTION + 00000A90
```

Analysis of the bugcheck dump will indicate one or more entries on the "FBIJBL" queue similar to the following:

```
FBIJBL @1C3109C0:         QUE = 16E5B0F8:16E5B0F8
    +-------------------------------------------------------+
    | This JFA 0            Record sequence number 640      |
    | Prior JFA 94096       Previous TSN was 0:3390022611    |
    | Modified segment 911:11828:16 with length of 64 bytes  |
    +-------------------------------------------------------+
```

The cause of the problem was related to an incorrect synchronization between processes manipulating the locked and free space while adding lines to the page.

This problem has been corrected in Oracle Rdb Release 7.2.5. Oracle recommends that all Rdb installations upgrade to at least Oracle Rdb Release 7.2.5 to implement the correction.

7.1.9 ALTER TABLE Fails With Constraint Violation

Bug 4904254

A customer reported that RMU/VERIFY/ALL reported incorrect constraint failure.

```
%RMU-W-CONSTFAIL, Verification  of constraint
%RDB-E-NO_META_UPDATE, metadata update failed
-RDB-E-INTEG_FAIL, violation of constraint CODE_NOT_IN_T2 caused operation
to fail
```

The constraint was checked in SQL and showed no violations.

The following ALTER TABLE statement is the equivalent SQL which shows the constraint failure:

```
alter table T1 add constraint
 constraint CODE_NOT_IN_T2
 check
 (exists
 (select pcode from T2 a
  where a.pcode = T1.pcode and
        a.ptype in
        ('BOX','BUL','COL','ROL','TPP','TPN','CON','SHE')))
 deferrable;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDB-E-INTEG_FAIL, violation of constraint CODE_NOT_IN_T2 caused operation
to fail
-RDB-F-ON_DB, on database <directory_spec>TESTDB.RDB;1
rollback;
```

The key parts of this cursor query which contributed to the situation leading to the error are these:

1. The main query is an ALTER TABLE statement on a table to add a constraint
2. The CHECK contains an EXISTS statement of SELECT query with IN clause and a join predicate

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.10 Increased Default for RDMS$BIND_WORK_VM and Relocation of Related VM Buffer to P2 Virtual Address Space

When executing certain kinds of queries that yield large record streams, the Oracle Rdb optimizer may have to create an intermediate table to store the results of a subquery. Oracle Rdb stores these results in sorted order for further execution in join operations.

The RDMS$BIND_WORK_VM logical name can reduce the overhead of disk I/O operations for matching operations that utilize the internal intermediate table. This logical name lets you specify the amount of virtual memory (VM) in bytes that will be allocated to your process for use as a buffer for the subquery results. Once the allocation is exhausted, additional data values are written to a temporary file on disk.

In prior versions of Oracle Rdb, the buffers for these subquery results were allocated in 32−bit process (P0) virtual address space. For some complex queries, the 1GB size of P0 space drastically limited the viable size of the internal buffers where larger buffers would otherwise increase performance by avoiding disk file IO.

This problem has been corrected in Oracle Rdb Release 7.2.5. The internal buffers have been moved to 64−bit process (P2) virtual address space in order to both reduce use of 32−bit process (P0) virtual address space and to permit much larger buffers to be utilized. In addition, the default value for the RDMS$BIND_WORK_VM logical name has been increased from 10,000 bytes to 100,000 bytes. The maximum value is 2,147,483,647 (2GB).

7.1.11 Full Outer Join Query Returns Wrong Column Values When Outer Table is Empty

Bug 9975516

In prior releases of Oracle Rdb, the following example returns wrong column values when the outer table is empty:

```
create table ta (fx char(3), fy char(1));
create table tb (fx char(3), fy char(1));

create unique index ia on ta (fx);
create unique index ib on tb (fx);

! insert one row in TA
insert into ta values ( 'AAA', '1');

! insert two rows in TB
insert into tb values ( 'ABC', '1');
insert into tb values ( 'BBB', '1');
```

```
! the full outer join returns correctly
select * from ta a full outer join tb b on a.fx = b.fx;
 A.FX   A.FY   B.FX   B.FY
 AAA    1      NULL   NULL
 NULL   NULL   ABC    1
 NULL   NULL   BBB    1
3 rows selected

!If all the rows in table "ta" are deleted, the same query returns the correct
!number of rows but wrong column values for the inner table "tb":

delete from ta;
1 row deleted

select * from ta a full outer join tb b
on a.fx = b.fx;
 A.FX   A.FY   B.FX   B.FY
 NULL   NULL   ...    .
 NULL   NULL   ...    .
2 rows selected

!We would expect to see the following correct result:
 A.FX   A.FY   B.FX   B.FY
 NULL   NULL   ABC    1
 NULL   NULL   BBB    1
2 rows selected
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.12 Reduction in Use of Rdb Executive Sort P0 Address Space

Previously, large data structures used by internal SORT code within Rdb were allocated in program (P0) virtual memory address space. In some cases, these data structures could consume considerable space and could lead to exceeding the capacity of P0 address space.

The impact of this situation has been reduced in Oracle Rdb Release 7.2.5. Several of the large data structures used by internal SORT code within Rdb have been moved to 64−bit P2 virtual memory address space.

7.1.13 Attaching to Rdb at Remote Site Stalls

Bug 9263939

Sometimes when attempting to attach to a remote Rdb database, the local process would enter a wait state and stall. This would most likely occur when there were other processes also attempting remote attaches.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.14 Increased Default Use of "Quick Sort"

The default size of an internal "quick sort" buffer has been increased from 20,000 bytes to 409,600 bytes and the default record limit for an internal "quick sort" has been increased from 63 to 5000. These changes should

provide for improved performance of sort operations for a larger set of cases.

Note that this internal buffer is located in P2 virtual address space so the increased size should not impact use of P0 virtual address space. It is possible that the increased default size might require additional process working set size in order to avoid excessive page faulting.

The logical name RDMS$BIND_MAX_QSORT_COUNT is used to restrict the number of rows that can be stored within the "quick sort" buffer. If required to revert to the prior maximum record count, this logical name can be defined as follows:

- DEFINE RDMS$BIND_MAX_QSORT_COUNT 63

Duplicate Handling During Sort Operations

The handling of row items duplicate key values during any sort operation is undefined in terms of the returned row order. Consider a query similar to "SELECT A,B FROM T ORDER BY A". If there are duplicate values for colum A, the order of output for column B is undefined and may potentially change from one execution of the query to another. If a specific order of values for column B is required, it must be explicitly specified in the ORDER BY clause.

7.1.15 Bugcheck While In PSII2INSERTDUPBBC

In unusual cases, when inserting duplicate entries into a sorted ranked index, it was possible for Rdb to bugcheck with an exception "footprint" similar to the following:

```
***** Exception at FFFFFFFF80002840 : symbol not found
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
virtual address=0000000010048000, PC=FFFFFFFF80002840, PS=00000009
Saved PC = FFFFFFFF856874D0 : RDMSHRP72\PSII2INSERTDUPBBC + 00003230
Saved PC = FFFFFFFF8567F9E0 : RDMSHRP72\PSII2INSERTBOTTOM + 00000B80
Saved PC = FFFFFFFF85664900 : RDMSHRP72\PSII2INSERTT + 00000400
Saved PC = FFFFFFFF85664E00 : RDMSHRP72\PSII2INSERTT + 00000900
Saved PC = FFFFFFFF85664E00 : RDMSHRP72\PSII2INSERTT + 00000900
Saved PC = FFFFFFFF85664E00 : RDMSHRP72\PSII2INSERTT + 00000900
Saved PC = FFFFFFFF85664E00 : RDMSHRP72\PSII2INSERTT + 00000900
Saved PC = FFFFFFFF85664E00 : RDMSHRP72\PSII2INSERTT + 00000900
Saved PC = FFFFFFFF856676F0 : RDMSHRP72\PSII2INSERTTREE + 00000450
Saved PC = FFFFFFFF85C86E30 : RDMSHRP72\RDMS$$KOD_INSERT_TREE + 00006AB0
Saved PC = FFFFFFFF85C04160 : RDMSHRP72\RDMS$$EXE_ACTION + 00001480
Saved PC = FFFFFFFF85D00E40 : RDMSHRP72\RDMS$$C_EXE_ACTION + 00000080
Saved PC = FFFFFFFF855C9DA0 : RDMSHRP72\RDMS_EXE_INTERP + 0000FD50
Saved PC = FFFFFFFF85C61690 : RDMSHRP72\RDMS$TOP_RECEIVE_BUFFER + 00001FC0
Saved PC = FFFFFFFF85C56340 : RDMSHRP72\RDMS$TOP_START_AND_SEND + 00001D80
Saved PC = FFFFFFFF866FC1A0 : RDMSHRP72\AMAC$EMUL_CMPC5 + 00002040
Saved PC = FFFFFFFF86461E40 : RDMSHRP72\KODSTREAM$JACKET + 00000130
```

In some cases, this problem may have been caused by an internal data structure being overwritten, leading to an incorrect length being calculated. It was possible for other memory structures to be compromised as well, leading to various different symptoms.

This problem has been corrected in Oracle Rdb Release 7.2.5. The data structure length is now correctly

calculated. All customers utilizing SORTED RANKED indexes are encouraged to upgrade to this release.

7.1.16 Divide Operator Now Returns DOUBLE PRECISION Results Rather than REAL

With this release of Oracle Rdb, all division operations (including the AVG statistical function) will produce DOUBLE PRECISION results. In prior releases, divide operations that involved small numeric values (TINYINT, SMALLINT, and short integer literals) resulted in REAL results (single precision) with some loss of accuracy.

This will affect AVG or expressions that contain division (/) operators. The result might be visible as a change in type for COMPUTED BY columns, AUTOMATIC AS columns, and view select expressions. Existing applications which expect to receive REAL results will cause Oracle Rdb to implicitly convert from DOUBLE PRECISION to REAL. Applications that use Dynamic SQL should ensure that the handling of floating types is consistent with either REAL or DOUBLE PRECISION results.

In addition, on Itanium systems, some arithmetic opertions that result in REAL results (single precision floating point) previously were performed in single precision IEEE S floating point format. These arithmetic operations are now performed in double precision IEEE T floating point format and the results are converted to REAL (single precision floating point) format. This may result in slightly greater precision in some cases.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.17 Unexpected Results From IN Clause on a Subselect Containing FETCH FIRST or LIMIT TO

Bugs 10244544 and 9500560

In prior versions of Oracle Rdb, the "Index counts lookup" optimization could be incorrectly applied to a query using a SORTED RANKED index that also included a LIMIT TO (or FETCH FIRST) clause. The result was extra rows being returned from the query.

The following example shows this problem with an IN clause referencing a subquery containing a FETCH FIRST ROWS ONLY clause. This clause is equivalent to the Rdb SQL LIMIT TO 1 ROWS clause.

```
SQL> select a
cont>  from tt11
cont>  where a in (select a
cont>        from tt11
cont>        order by a desc
cont>        fetch first row only);
Tables:
  0 = TT11
  1 = TT11
Cross block of 2 entries  Q1
  Cross block entry 1
    Index only retrieval of relation 0:TT11
      Index name  TT11_INDEX [0:0]
  Cross block entry 2
    Conjunct: <agg0> <> 0
    Aggregate-F1: 0:COUNT-ANY (<subselect>) Q2
    Conjunct: 0.A = 1.A
```

```
    Firstn: 1
    Index only retrieval of relation 1:TT11
      Index name  TT11_INDEX [0:0]  Reverse Scan  Index counts lookup
           A
         164
         164
...
         471
         471
274 rows selected
SQL>
```

The correct results should be limited to the rows matching only the maximum values (selected by sorting the values in descending order) for TT11 column A.

```
SQL> select a
cont>  from tt11
cont>  where a = (select a
cont>       from tt11
cont>       order by a desc
cont>       fetch first row only);
Tables:
  0 = TT11
  1 = TT11
Cross block of 2 entries  Q1
  Cross block entry 1
    Aggregate: 0:VIA (1.A) Q2
    Firstn: 1
    Index only retrieval of relation 1:TT11
      Index name  TT11_INDEX [0:0]   Reverse Scan
  Cross block entry 2
    Index only retrieval of relation 0:TT11
      Index name  TT11_INDEX [1:1]
        Keys: 0.A = <agg0>
           A
         471
         471
         471
3 rows selected
SQL>
```

The workaround for this problem is to define RDMS$SET_FLAGS as "NOCOUNT_SCAN" or use SET FLAGS 'NOCOUNT_SCAN' in SQL.

This problem has been corrected in Oracle Rdb Release 7.2.5. The Rdb optimizer now detects this case and automatically disables the "Index counts lookup" optimization.

7.1.18 Translation From HEX Character Set is Incorrect

Bug 10265503

A problem with character set translation, introduced in V7.2 Oracle Rdb, will prevent the correct translation of literals, variables and columns if the character set of the source object is HEX.

The following example shows this problem.

```
SQL> select translate (_hex'4142' using rdb$isolatin1) from rdb$database;
```

```
 3431
1 row selected
SQL>
```

The correct results should be the translation of the hexadecimal value to the appropriate characters within the destination character set.

```
SQL> select translate (_hex'4142' using rdb$isolatin1) from rdb$database;

 AB
1 row selected
SQL>
```

A workaround for this problem, if the source is a literal, is to use the hexadecimal literal specifier as in the following example.

```
SQL> select x'4142'  from rdb$database;

 AB
1 row selected
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5. Rdb now carries out the correct translation.

7.1.19 Nested Query With Left Outer Join and GROUP BY Bugchecks During Query Compilation

Bug 10266984

In prior releases of Oracle Rdb, the following query, nested with LEFT OUTER JOIN and GROUP BY, bugchecks during query compilation.

```
SELECT
  dt1.inv_date,
  dt1.method,
  sum(dt1.cnt)
FROM    ! derived table:dt1
 (SELECT
    dt2.inv_id,
    dt2.inv_date,
    t4.method,
    dt2.cnt
  FROM  ! derived table:dt2
   (SELECT
        t1.inv_id,
        t1.inv_date,
        t2.bid,
        t3.sid,
        sum(t2.quantity)
    FROM
        HEADER t1 JOIN
        DETAIL t2
            on (t2.inv_id=t1.inv_id)
        LEFT JOIN SPLIT t3
            on (t3.inv_id = t1.inv_id and
                t3.detail_glue = t2.detail_glue)
```

```
    WHERE
          t1.inv_date>'01-MAR-2010' and
          t1.cancel = 'F' and
          t1.form = 'F' and
          t2.quantity > 0
    GROUP BY
        t1.inv_id,
        t1.inv_date,
        t2.bid,
        t3.sid
     ) dt2        ! Derived table
        (inv_id,
         inv_date,
         bid,
         sid,
         cnt)
    JOIN SO_INVOICE_BOX_REC t4
         on (t4.inv_id = dt2.inv_id and
             t4.bid = dt2.bid )
    WHERE t4.method <> 'OTHR' or
          t4.cid <> 'OTHR' or
          t4.weight > 1
   ) dt1 (inv_id,    ! Derived table
        inv_date,
        method,
        cnt)
  GROUP BY
    dt1.inv_date,
    dt1.method
    limit 5;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file DISK:[DIRECTORY]RDSBUGCHK.DMP;
%RDB-F-BUG_CHECK, internal consistency check failed
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.20 Query With Nested Left Outer Join Bugchecks With Floating Overflow

Bug 10185583

In prior releases of Oracle Rdb, the following query, with nested LEFT OUTER JOIN, bugchecks with floating overflow.

```
SELECT count(*)
FROM TABLE1
LEFT OUTER JOIN TABLE2
ON TABLE2.COL_193= 'C10014' and TABLE2.COL_194= '00'

LEFT OUTER JOIN TABLE3
ON TABLE3.COL_193= 'C10014' and TABLE3.COL_194= '00'

LEFT OUTER JOIN TABLE4
ON TABLE4.COL_193= 'C10014' and TABLE4.COL_194= '00'

LEFT OUTER JOIN
  (select COL_197, COL_198, COL_046 ALIAS014 from TABLE5 where COL_197='C10014'
   and COL_198='00' and COL_039='EIS' and COL_043='REL' and COL_200=1) TBL_TBL008
ON TABLE1.COL_193=TBL_TBL008.COL_197 and TABLE1.COL_194=TBL_TBL008.COL_198
```

```
LEFT OUTER JOIN
  (select COL_197, COL_198, COL_046 ALIAS015 from TABLE5 where COL_197='C10014'
   and COL_198='00' and COL_039='EIS' and COL_043='REL' and COL_200=2) TBL_TBL009
ON TABLE1.COL_193=TBL_TBL009.COL_197 and TABLE1.COL_194=TBL_TBL009.COL_198

LEFT OUTER JOIN
  (select COL_197, COL_198, COL_046 ALIAS010 from TABLE5 where COL_197='C10014'
   and COL_198='00' and COL_039='EIS' and COL_043='GER' and COL_200=1) TBL_TBL004
ON TABLE1.COL_193=TBL_TBL004.COL_197 and TABLE1.COL_194=TBL_TBL004.COL_198

...followed by a series of left outer join here...

LEFT OUTER JOIN
  (select COL_197, COL_198, COL_046 ALIAS007 from TABLE5 where COL_197='C10014'
   and COL_198='00' and COL_039='APA' and COL_043='APA') tbl_ALIAS007
ON TABLE1.COL_193=tbl_ALIAS007.COL_197 and TABLE1.COL_194=tbl_ALIAS007.COL_198

LEFT OUTER JOIN
  (select COL_197, COL_198, COL_046 ALIAS048 from TABLE5 where COL_197='C10014'
   and COL_198='00' and COL_039='TYP' and COL_043='GIN') TBL_TBL033
ON TABLE1.COL_193=TBL_TBL033.COL_197 and TABLE1.COL_194=TBL_TBL033.COL_198

WHERE TABLE1.COL_193= 'C10014'
      AND TABLE1.COL_194= '00'
;
%RDB-E-ARITH_EXCEPT, truncation of a numeric value at runtime
-SYSTEM-F-HPARITH, high performance arithmetic trap, Imask=00000000, Fmask=00000
001, summary=08, PC=00000000008062F4, PS=0000001B
-SYSTEM-F-FLTOVF, arithmetic trap, floating overflow at PC=00000000008062F4, PS=
0000001B
```

This query works if the SET FLAGS OLD_COST_MODEL is applied.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.21 DBR Process Waiting for RMS Lock While Adding Process Rights

In rare cases, it is possible for a database recovery (DBR) process to be involved in a deadlock involving a lock on the system RIGHTSLIST file.

This problem has been corrected in Oracle Rdb Release 7.2.5. The DBR process does not grant itself additional rights until after it has gained the database freeze lock and notified the monitor that the failed user process may exit.

7.1.22 DBR Bugcheck at RUJUTL$ROLLBACK_LOOP + 00000760

Bug 10296522

Under certain circumstances, it may be possible for a Database Recovery Process (DBR) to fail while trying to recover a user process, even when there is nothing to recover. This failure would generate a RDMDBRBUG.DMP file and cause the database to shutdown. Once the shutdown occurs, a subsequent

recovery operation will be successful and the database will again be accessible.

For this problem to occur, Row Cache must be enabled and an RMU/BACKUP/AFTER must occur between the time that a user process commits one transacation and starts another transaction, which then fails before doing any database updates.

The DBR fails because of a missing checkpoint record.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.23 Rdb Monitor Log File Write Rate Reduced

The Oracle Rdb Monitor process (RDMMON) previously would write to the monitor log file using an IO size of either 127 or 124 disk blocks and would perform a RMS "flush" operation once per minute.

With this release of Oracle Rdb, the Monitor process now anticipates that OpenVMS patch(es) have been installed that support using a RMS Multi Block Count (MBC) parameter larger than 127 blocks. The Oracle Rdb Monitor process will first attempt to use a larger value and if a RMS$_MBC error is returned from the SYS$CONNECT call to the log file, a second attempt is made with a RMS Multi Block Count (MBC) parameter of less than 128.

In addition, the Oracle Rdb Monitor process reduces the frequency of monitor log file "flush" operations to once every ten minutes.

For some sites with significant monitor log file write activity, these changes should serve to reduce physical IO.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.24 Memory Layout Change For Global Section

Bug 11741649

In order to help prevent cases where shared memory is unexpectedly overwritten, the internal layout of certain data structures has been altered to include additional "guard" pages within Rdb's memory management subsystem.

These changes are intended to help detect and prevent unexpected memory write access to the database global section.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.25 CONCAT on Operands of Same Datatype and Same Size Bugchecks

Bug 11867911

In prior releases of Oracle Rdb, the following query with CONCAT bugchecks.

```
SELECT COUNT(*) FROM T1 WHERE
  COL1 = '13900' AND
  COL2
      || COL3
      || COL4
      || CAST(COL5 + 1999 AS CHAR(4))
   >
    '            '
      || '   '
      || '        '
      || CAST(0 + 1999 AS CHAR(4))
   ;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file _[directory]RDSBUGCHK.DMP;
```

The query works if the dialect is set to 'ORACLE LEVEL2', as in the following example.

```
SET DIALECT 'ORACLE LEVEL2';

SELECT COUNT(*) FROM T1 WHERE
  COL1 = '13900' AND
  COL2
      || COL3
      || COL4
      || CAST(COL5 + 1999 AS CHAR(4))
   >
    '            '
      || '   '
      || '        '
      || CAST(0 + 1999 AS CHAR(4))
   ;
Tables:
  0 = T1
Aggregate: 0:COUNT (*) Q2
Leaf#01 BgrOnly 0:T1 Card=244646
  Bool: (0.COL1 = '13900') AND (CONCAT (0.COL2, 0.COL3,
        0.COL4, CAST ((0.COL5 + 1999) AS CHAR(4))) >
        CONCAT ('            ', '   ', '        ', CAST ((0 + 1999) AS CHAR(4)))
        )
  BgrNdx1 T1_NDX1 [1:1] Fan=8
    Keys: 0.COL1 = '13900'
  BgrNdx2 T1_NDX2 [0:0] Fan=14
    Bool: CONCAT (0.COL2, 0.COL3, 0.COL4, CAST ((
          0.COL5 + 1999) AS CHAR(4))) > CONCAT ('            ', '   ',
          '        ', CAST ((0 + 1999) AS CHAR(4)))

        8525
1 row selected
```

The query bugchecks when the left operands of the CONCAT are the same datatype and same size as the right operands.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.26 SQLSRV−E−PWDEXPIRED Error Restored

Bug 11831591

In Oracle SQL/Services releases prior to 7.3.0.3, if a user account's password was expired, an attempt to

connect got the SQLSRV−E−PWDEXPIRED error. When intrusion detection was added in Release 7.3.0.3 of SQL/Services, this error changed to SQLSRV−F−GETACCINF. Therefore, applications were unable to trap expired password errors in order to prompt the user for a new password.

In Oracle SQL/Services Release 7.3.1, the SQLSRV−E−PWDEXPIRED error has been restored and the SQLSRV−F−GETACCINF error will no longer be returned in this case.

This kit provides the RDB$COSIP.EXE image required to support this change to the SQL/Services behavior.

7.1.27 Query Returns Wrong Result and Bugchecks at Exit Using Bitmapped Scan

Bug 11076142

In prior releases of Oracle Rdb, the following query would return wrong results using Bitmapped Scan and would bugcheck at exit time.

```
set flags 'bitmapped_scan';
select distinct DETAIL  from T2 B, T1 M
where B.TYP = M.PID and
      M.NUMTYP = 'T_TYP' ;
Tables:
  0 = T2
  1 = T1
Reduce: 0.DETAIL
Sort: 0.DETAIL(a)
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 1.NUMTYP = 'T_TYP'
    Index only retrieval of relation 1:T1
      Index name  IDX_EMAP_1 [0:0]
  Cross block entry 2
    Leaf#01 NdxOnly 0:T2 Card=1671  Bitmapped scan
      Bool: 0.TYP = 1.PID
      FgrNdx  IDX_BSKT_0 [0:0] Fan=29
      BgrNdx1 IDX_BSKT_1 [1:1] Fan=48
        Keys: 0.TYP = 1.PID
 B.DETAIL
       11
1 row selected

! the bugcheck occurs at the exit time
exit
%RDMS−I−BUGCHKDMP, generating bugcheck dump file _[directory]RDSBUGCHK.DMP;
```

Disabling bitmapped scan (SET FLAGS 'NOBITMAPPED_SCAN) eliminates the problem.

```
set flags 'nobitmapped_scan';
select distinct DETAIL  from T2 B, T1 M
where B.TYP = M.PID and
      M.NUMTYP = 'T_TYP' ;
Tables:
  0 = T2
  1 = T1
Reduce: 0.DETAIL
Sort: 0.DETAIL(a)
```

```
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: TRIM (BOTH ' ' FROM 1.NUMTYP) = 'T_TYP'
    Index only retrieval of relation 1:T1
      Index name  IDX_EMAP_1 [0:0]
  Cross block entry 2
    Leaf#01 NdxOnly 0:T2 Card=1671
      Bool: 0.TYP = 1.PID
      FgrNdx  IDX_BSKT_0 [0:0] Fan=29
      BgrNdx1 IDX_BSKT_1 [1:1] Fan=48
        Keys: 0.TYP = 1.PID
 B.DETAIL
        2
        3
       11
3 rows selected
```

Dropping the foreground index also makes the query return correctly.

```
drop index IDX_BSKT_0;

set flags 'bitmapped_scan';
select distinct DETAIL  from T2 B, T1 M
where B.TYP = M.PID and
      M.NUMTYP = 'T_TYP' ;

Tables:
  0 = T2
  1 = T1
Reduce: 0.DETAIL
Sort: 0.DETAIL(a)
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 1.NUMTYP = 'T_TYP'
    Index only retrieval of relation 1:T1
      Index name  IDX_EMAP_1 [0:0]
  Cross block entry 2
    Leaf#01 NdxOnly 0:T2 Card=1671  Bitmapped scan
      Bool: 0.TYP = 1.PID
      BgrNdx1 IDX_BSKT_1 [1:1] Fan=48
        Keys: 0.TYP = 1.PID
 B.DETAIL
        2
        3
       11
3 rows selected
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.28 Query Runs Very Slow When Using Bitmapped Scan

Bug 10297647

In prior releases of Oracle Rdb, the following query runs very slow using Bitmapped Scan when one of the joined tables contains over 6 million rows.

```
set flags 'bitmapped_scan';
select 1
from T1
```

```
where
    I_ASN is not null
    and I_MCAT is not null
    and not exists (select *
                    from T2
                    where T1.I_ASN = T2.I_ASN
                        and T1.I_MCAT = T2.I_MCAT);
Tables:
  0 = T1
  1 = T2
Conjunct: <agg0> = 0
Match    (Agg Outer Join)  Q1
  Outer loop
  Match_Keys:0.I_MCAT, 0.I_ASN
    Sort: 0.I_MCAT(a), 0.I_ASN(a)
    Leaf#01 BgrOnly 0:T1 Card=6311566 Bitmapped scan
      Bool: NOT MISSING (0.I_ASN) AND NOT MISSING (0.I_MCAT)
      BgrNdx1 IX_DCAT_MCAT [0:1] Fan=39
        Keys: NOT MISSING (0.I_MCAT)
      BgrNdx2 IX_DCAT_ASN_TST_REC_TYP_A_V [0:1] Fan=42
        Keys: NOT MISSING (0.I_ASN)
  Inner loop
  Match_Keys:1.I_MCAT, 1.I_ASN
    Aggregate: 0:COUNT-ANY (<subselect>) Q2
    Sort: 1.I_MCAT(a), 1.I_ASN(a)
    Conjunct: NOT MISSING (1.I_MCAT)
    Leaf#02 BgrOnly 1:T2 Card=3325      Bitmapped scan
      Bool: NOT MISSING (1.I_ASN)
      BgrNdx1 IX_MCAT_ASN [0:1] Fan=39
        Keys: NOT MISSING (1.I_ASN)
      BgrNdx2 IX_MCAT_PK [0:1] Fan=39
        Keys: NOT MISSING (1.I_MCAT)
0 rows selected
show stat

                  process statistics at 13-DEC-2010 11:32:55.44
         elapsed time =   0 00:01:08.14              CPU time =   0 00:00:04.37
     page fault count = 1061             pages in working set = 52928
   buffered I/O count = 81                   direct I/O count = 8563
      open file count = 8                 file quota remaining = 1992
           locks held = 149                    locks remaining = 31851
      CPU utilization = 6.4%              AST quota remaining = 995
```

Disabling bitmapped scan (SET FLAGS 'NOBITMAPPED_SCAN) eliminates the problem.

```
set flags 'nobitmapped_scan';
select 1
from TB_DCAT
where
    I_ASN is not null
    and I_MCAT is not null
    and not exists (select *
                    from TB_MCAT
                    where TB_DCAT.I_ASN = TB_MCAT.I_ASN
                        and TB_DCAT.I_MCAT = TB_MCAT.I_MCAT);
Tables:
  0 = TB_DCAT
  1 = TB_MCAT
Conjunct: <agg0> = 0
Match    (Agg Outer Join)  Q1
  Outer loop
  Match_Keys:0.I_MCAT, 0.I_ASN
```

```
    Sort: 0.I_MCAT(a), 0.I_ASN(a)
    Leaf#01 BgrOnly 0:TB_DCAT Card=155000
      Bool: NOT MISSING (0.I_ASN) AND NOT MISSING (0.I_MCAT)
      BgrNdx1 IX_DCAT_MCAT [0:1] Fan=20
        Keys: NOT MISSING (0.I_MCAT)
      BgrNdx2 IX_DCAT_ASN_TST_REC_TYP_A_V [0:1] Fan=11
        Keys: NOT MISSING (0.I_ASN)
  Inner loop
  Match_Keys:1.I_MCAT, 1.I_ASN
    Aggregate: 0:COUNT-ANY (<subselect>) Q2
    Sort: 1.I_MCAT(a), 1.I_ASN(a)
    Conjunct: NOT MISSING (1.I_MCAT)
    Leaf#02 BgrOnly 1:TB_MCAT Card=3336
      Bool: NOT MISSING (1.I_ASN)
      BgrNdx1 IX_MCAT_ASN [0:1] Fan=20
        Keys: NOT MISSING (1.I_ASN)
      BgrNdx2 IX_MCAT_PK [0:1] Fan=20
        Keys: NOT MISSING (1.I_MCAT)
0 rows selected
show stat

                  process statistics at 13-DEC-2010 11:31:47.29
         elapsed time =   0 00:01:48.09              CPU time =   0 00:00:01.72
     page fault count = 49               pages in working set = 35584
   buffered I/O count = 114                  direct I/O count = 8655
      open file count = 8                 file quota remaining = 1992
           locks held = 149                    locks remaining = 31851
      CPU utilization = 1.5%               AST quota remaining = 995
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.29 Query With "NOT (conj1 OR conj2 OR conj3)" Predicate Bugchecks

Bug 11850015

In prior releases of Oracle Rdb, the following query with "NOT (conj1 OR conj2 OR conj3)" bugchecks at setup_for_no_get.

```
select * from all_cat where
    t_type <> 'SEQ' and t_type <> 'SYN' and
    not (owner = 'MSYS' OR owner = 'OSYS' OR owner = 'WSYS');
%RDMS-I-BUGCHKDMP, generating bugcheck dump file _[directory]RDSBUGCHK.DMP;
```

This query worked in Oracle Rdb Release 7.2.4.1 and started breaking in Oracle Rdb Release 7.2.4.2 due to a fix for Bug 9509316.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.30 Query Returns Wrong Results Using Bitmap Scan With Zigzag Match

Bug 8344512

When bitmapped scan is used on sorted ranked indices, this metadata query returns no results.

```
Tables:
  0 = RDB$CONSTRAINT_RELATIONS
  1 = RDB$CONSTRAINTS
  2 = RDB$RELATION_CONSTRAINTS
Reduce: 0.RDB$CONSTRAINT_NAME
Cross block of 2 entries  Q1
  Cross block entry 1
    Conjunct: 1.RDB$CONSTRAINT_NAME = 0.RDB$CONSTRAINT_NAME
    Match  Q1
      Outer loop      (zig-zag)
      Match_Key:0.RDB$CONSTRAINT_NAME
      Index_Key:RDB$CONSTRAINT_NAME
        Leaf#01 Sorted 0:RDB$CONSTRAINT_RELATIONS Card=8         Bitmapped scan
          Bool: 0.RDB$RELATION_NAME = <var0>
          FgrNdx  RDB$CR_CONSTRAINT_NAME_NDX [0:0] Fan=8
          BgrNdx1 RDB$CR_REL_NAME_NDX [1:1] Fan=8
            Keys: 0.RDB$RELATION_NAME = <var0>
      Inner loop      (zig-zag)
      Match_Key:1.RDB$CONSTRAINT_NAME
      Index_Key:RDB$CONSTRAINT_NAME
        Get     Retrieval by index of relation 1:RDB$CONSTRAINTS
          Index name  RDB$CON_CONSTRAINT_NAME_X [0:0]
  Cross block entry 2
    Conjunct: <agg0> = 0
    Aggregate-F1: 0:COUNT-ANY (<subselect>) Q2
    Index only retrieval of relation 2:RDB$RELATION_CONSTRAINTS
      Index name  RDB$RLC_CONSTRAINT_NAME_NDX [1:1]  Direct lookup
        Keys: 1.RDB$CONSTRAINT_NAME = 2.RDB$CONSTRAINT_NAME


This script works with SORTED index:

set verify;
drop database
    filename pers;
import database
    from 'test$db_source:personnel_sql'
    filename 'pers'
    system index (type is sorted);
set flags 'strategy,detail(2)';
show table (constraint) employees
disconnect all;

This script fails with RANKED index:

set verify;
drop database
    filename pers;
import database
    from 'test$db_source:personnel_sql'
    filename 'pers'
    system index (type is sorted ranked);
set flags 'bitmapped_scan,strategy,detail(2)';
show table (constraint) employees
disconnect all;
```

The problem can also be reproduced using either RDO or SQL, as can be seen in the following scripts:

```
FOR
```

```
    CR IN Rdb$CONSTRAINT_RELATIONS
    CROSS C IN Rdb$CONSTRAINTS
    OVER Rdb$CONSTRAINT_NAME
    WITH CR.Rdb$RELATION_NAME = 'EMPLOYEES' AND
        NOT ANY RC IN RdbVMS$RELATION_CONSTRAINTS
        WITH C.RDB$CONSTRAINT_NAME = RC.RDB$CONSTRAINT_NAME
print C.Rdb$CONSTRAINT_NAME
       ,C.Rdb$CONSTRAINT_SOURCE
END_FOR

SQL script:

select C.Rdb$CONSTRAINT_NAME,C.Rdb$CONSTRAINT_SOURCE
  FROM Rdb$CONSTRAINT_RELATIONS CR
       JOIN
       Rdb$CONSTRAINTS C
       ON CR.Rdb$CONSTRAINT_NAME = C.Rdb$CONSTRAINT_NAME
  where
      CR.Rdb$RELATION_NAME = 'EMPLOYEES' AND
      NOT EXISTS
      (select * from RdbVMS$RELATION_CONSTRAINTS RC
        where C.RDB$CONSTRAINT_NAME = RC.RDB$CONSTRAINT_NAME);
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.1.31 Query With Over 26 Million Rows Slows Down

Bug 9454843

In prior releases of Oracle Rdb, a query became very slow due to a million blocks being allocated for a sort that is done repeatedly that usually involves only a handful of records.

One of the tables has over 26 million rows, but there are nearly 6 million values for DEBT_ID so the average number of rows to sort is under 5.

The following is the simplified version of the query.

```
select *
from
    DEBT as C2,
    DEBT as C33
    left outer join
    (select C36.DEBT_ID, C36.TRANSACTION_ID, sum(
        C36.CURRENT_BALANCE_AMOUNT)
        from BALANCE_HISTORY C36
        group by C36.DEBT_ID, C36.TRANSACTION_ID)
    as C34 (F1, F2, F3)
         on (C34.F1 = C33.DEBT_ID)
            and (C34.F2 = (select C52.TRANSACTION_ID from
                    BALANCE_HISTORY C52
                where (((C52.DEBT_ID = C33.DEBT_ID)
                    and (C52.BALANCE_TYPE_CODE = 'DBC'))
                        )
                order by C52.CHANGE_TIME desc
                limit to 1 rows))
    where
        (C33.DEBT_ID = C2.DEBT_ID);
Tables:
```

```
  0 = DEBT
  1 = DEBT
  2 = BALANCE_HISTORY
  3 = BALANCE_HISTORY
Conjunct: 1.DEBT_ID = 0.DEBT_ID
Match  Inner_TTBL Q1
  Outer loop      (zig-zag)
  Match_Key:0.DEBT_ID
  Index_Key:DEBT_ID
    Get     Retrieval by index of relation 0:DEBT
      Index name  DEBT_PK [0:0]
  Inner loop
  Match_Key:1.DEBT_ID
    Temporary relation
    Cross block of 2 entries        (Left Outer Join)  Q4
      Cross block entry 1
        Cross block of 2 entries  Q6
          Cross block entry 1
            Get     Retrieval by index of relation 1:DEBT
              Index name  DEBT_PK [0:0]
          Cross block entry 2
            Aggregate: 0:VIA (3.TRANSACTION_ID) Q5
            Firstn: 1
            Sort: 3.CHANGE_TIME(d)
              SortId# 4., # Keys 2
                Item# 1, Dtype: 2, Order: 1, Off: 0, Len: 1
                Item# 2, Dtype: 35, Order: 1, Off: 1, Len: 8
                LRL: 40, NoDups:0, Blks:64423, EqlKey:0, WkFls: 2
            Leaf#01 BgrOnly 3:BALANCE_HISTORY Card=26384512
              Bool: (3.DEBT_ID = 1.DEBT_ID) AND (3.BALANCE_TYPE_CODE = 'DBC')
              BgrNdx1 BALANCE_HISTORY_PK [2:2] Fan=9
                Keys: (3.DEBT_ID = 1.DEBT_ID) AND (3.BALANCE_TYPE_CODE = 'DBC')
      Cross block entry 2
        Conjunct: 2.DEBT_ID = 1.DEBT_ID
        Merge of 1 entries  Q4
          Merge block entry 1  Q2
          Aggregate: 1:SUM (2.CURRENT_BALANCE_AMOUNT) Q3
          Sort: 2.DEBT_ID(a), 2.TRANSACTION_ID(a)
            SortId# 5., # Keys 4
              Item# 1, Dtype: 2, Order: 0, Off: 0, Len: 1
              Item# 2, Dtype: 8, Order: 0, Off: 1, Len: 4
              Item# 3, Dtype: 2, Order: 0, Off: 5, Len: 1
              Item# 4, Dtype: 8, Order: 0, Off: 6, Len: 4
              LRL: 32, NoDups:0, Blks:1000000, EqlKey:0, WkFls: 2
          Leaf#02 BgrOnly 2:BALANCE_HISTORY Card=26384512
            BgrNdx1 BALANCE_HISTORY_PK [1:1] Fan=9
              Keys: 2.DEBT_ID = 1.DEBT_ID
0 rows selected
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2 SQL Errors Fixed

7.2.1 Unexpected Bugcheck When Using INSERT ... SELECT Into a View

Bug 9383578

In prior releases of Oracle Rdb, it was possible that using INSERT ... SELECT into a view based on another view would generate a bugcheck dump. This occurred when the base table contained DEFAULT values for some columns.

The following example shows the error reported by a customer.

```
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]RDSBUGCHK.DMP;
%RDB-E-INVALID_BLR, request BLR is incorrect at offset 1041
-RDMS-E-UNKNOWN_VAR, unknown variable 2 found in the query string
```

This problem could also occur when an INSERT was contained in a FOR cursor loop in a compound statement.

This problem has been corrected in Oracle Rdb Release 7.2.5. Rdb now correctly determines the context for the nested table when processing the DEFAULT value or AUTOMATIC INSERT AS values for a base table referenced by nested views.

7.2.2 Warning Now Issued for Unsupported Character Operations

This release of Oracle Rdb changes the behavior of the LIKE ... IGNORE CASE, UPPER and LOWER functions in the cases where they are applied to character string expressions with a character set that does not support casing (upper and lower case equivalent characters).

In previous versions of Oracle Rdb, UPPER and LOWER were accepted for these character sets but they are now ignored by SQL. That is, the UPPER and LOWER functions are discarded if the character set does not have upper and lower case characters. This would be applicable to a character set such as KANJI.

In previous versions LIKE ... IGNORE CASE would cause the query to fail if the character string expressions did not support casing. SQL now ignores this clause with an issued warning.

The following example shows the issued warnings.

```
SQL> create table kan ( a char(10) character set kanji);
SQL> select * from kan where a like _kanji'aa' ignore case;
%SQL-W-NOCASING, IGNORE CASE not supported for character set KANJI - ignored
0 rows selected
SQL> select * from kan where upper(a) = _kanji'aa';
%SQL-W-NOCASING, UPPER not supported for character set KANJI - ignored
0 rows selected
SQL> select * from kan where lower(a) = _kanji'aa';
```

```
%SQL-W-NOCASING, LOWER not supported for character set KANJI - ignored
0 rows selected
SQL> rollback;
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2.3 Incorrect Results From LIKE ... IGNORE CASE

In prior releases of Oracle Rdb, the LIKE ... IGNORE CASE predicate could return the wrong results if the pattern string included the "*" character.

The following example shows the incorrect results from LIKE ... IGNORE CASE. The LIKE ... IGNORE CASE example should have returned only two rows.

```
SQL> create table like_test
cont>     (TEXT varchar(10)
cont>     );
SQL> insert into like_test (TEXT) values ('abc');
1 row inserted
SQL> insert into like_test (TEXT) values ('abc*');
1 row inserted
SQL> insert into like_test (TEXT) values ('ABC');
1 row inserted
SQL> insert into like_test (TEXT) values ('ABC*');
1 row inserted
SQL>
SQL>
SQL> select * from like_test;
 TEXT
 abc
 abc*
 ABC
 ABC*
4 rows selected
SQL>
SQL> -- An ordinary, case sensitive, LIKE gets the proper results:
SQL>
SQL> select * from like_test where text like 'a%*%';
 TEXT
 abc*
1 row selected
SQL>
SQL> -- But when you IGNORE CASE things get weird:
SQL>
SQL> select * from like_test where text like 'a%*%' ignore case;
 TEXT
 abc
 abc*
 ABC
 ABC*
4 rows selected
SQL>
SQL> rollback;
```

Additionally, LIKE ... IGNORE CASE was ignoring diacritial markings, contrary to the LIKE documentation.

At the same time, several restrictions previously in place for this predicate have been removed.

```
SQL> select * from like_test where text like pattern || '%' ignore case;
%SQL-F-BADCOLIGNCAS, The LIKE pattern is incompatible with IGNORE CASE
SQL> select * from like_test where text like pattern ignore case;
%SQL-F-BADCOLIGNCAS, The LIKE pattern is incompatible with IGNORE CASE
SQL> declare :pat varchar(10) = 'a%*%';
SQL> begin
cont> for :l as select *
cont>     from like_test
cont>     where text like :pat ignore case
cont> do
cont>     trace :l.text;
cont> end for;
cont> end;
%SQL-F-MSP_LIKE_XLATE, Translation of LIKE pattern string not supported in a
compound statement
```

The predicate pattern can now be any expression (including a column reference) and may be used within a compound statement.

Oracle Rdb now supports a more general LIKE ... IGNORE CASE implementation which corrects these problems and lifts these restrictions.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2.4 Unexpected ACCVIO When Using Dynamic DECLARE Cursor Statement

Bug 9166313

In prior releases of Oracle Rdb, if a database or a user had transaction modes restricted to READ ONLY, it was possible for the SQL dynamic DECLARE of a list cursor to fail with an ACCVIO.

```
Declare list cursor SQLCODE = -1
 ** The parameter value returned is: 8347456
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=0000000000000001C, PC=00000000005851AC, PS=0000001B
```

A database can be altered to allow only READ ONLY transactions, as shown in this example:

```
alter database
    filename PERSONNEL
    set transaction modes (read only);
```

All users of such a database could see this problem when using dynamically declared cursors such as those used by ODBC, JDBC, SQL/Services or OCI Services for Rdb.

A single user can be assigned a profile that restricts the transactions to READ ONLY, as shown in this example:

```
create profile RO_PROFILE
    default transaction READ ONLY
    transaction modes (READ ONLY);

create user SAMPLE_USER
    identified externally
```

```
    profile RO_PROFILE;
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2.5 Incorrect Value Returned By RETURNING Clause of the INSERT Statement

Bug 10008867

In prior releases of Oracle Rdb, it was possible that using the RETURNING clause of the INSERT statement would evaluate an AUTOMATIC AS expression a second time, once for the INSERT and again if they were returned by the RETURNING clause. This could be problematic if the expression called a function that had side effects, such as updating the SEQUENCE, or performing some external action.

The following example shows that the value returned by the RETURNING clause is different from what was actually inserted.

```
SQL> declare :v1 integer;
SQL> declare :v1_ind integer;
SQL>
SQL> create sequence s1;
SQL>
SQL> create module m1
cont>     language SQL
cont>
cont>     function f1()
cont>       returns integer
cont>       not deterministic;
cont>     return s1.nextval;
cont>
cont> end module;
SQL>
SQL> create table t1
cont>     (c1 automatic insert as f1()
cont>     ,c2 char(10));
SQL>
SQL>insert into t1 (c2) values ('test1') returning c1 into :v1 indicator
:v1_ind;
1 row inserted
SQL> print :v1 indicator :v1_ind;
          V1
           2
SQL> select c1 from t1;
          C1
           1
1 row selected
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2.6 Unexpected Failure When Adding IDENTITY Columns

In previous releases of Oracle Rdb, using a delimited table name could cause the CREATE or ALTER TABLE statement to fail when an IDENTITY column was defined.

The following example shows this problem.

```
SQL> CREATE TABLE "Emps" (
cont>     "Id" int IDENTITY PRIMARY KEY ,
cont>     "Name" NCHAR VARYING(2000)
cont> );
%RDB-E-NO_META_UPDATE, metadata update failed
-RDB-E-OBSOLETE_METADA, request references metadata objects that no longer exist
-RDMS-E-SEQNEXTS, sequence "Emps" does not exist in this database
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5. Oracle Rdb was incorrectly uppercasing the name of the identity sequence.

7.2.7 Unexpected Bugcheck Dump Produced When UNION and GROUP BY Are Used

Bug 9952060

In prior releases of Oracle Rdb, it was possible in rare cases to have a bugcheck dump produced when a UNION also included a GROUP BY. The ON clause of a JOIN needs to reference the same GROUP BY expression in a subsequent UNION branch.

The following example shows the problem. The ON clause in the second part of the UNION uses the same GROUP BY expression as the first part of the UNION.

```
SQL> select substring (jh.employee_id from 1 for 5)
cont>  FROM job_history jh
cont>  JOIN salary_history sh
cont>    ON sh.employee_id = substring (jh.employee_id from 1 for 5)
cont>  GROUP BY substring (jh.employee_id from 1 for 5)
cont> UNION ALL
cont> SELECT substring (jh.employee_id from 1 for 5)
cont>  FROM job_history jh
cont>  JOIN salary_history sh
cont>    ON sh.employee_id = substring (jh.employee_id from 1 for 5)
cont> GROUP BY substring (jh.employee_id from 1 for 5)
cont> ;
%RDMS-I-BUGCHKDMP, generating bugcheck dump file USER2:[TESTING]SQLBUGCHK.DMP;
%SYSTEM-F-ACCVIO, access violation, reason mask=00,
virtual address=00000000000000D4, PC=FFFFFFFF8027E8C1, PS=0000001B
```

This problem has been corrected in Oracle Rdb Release 7.2.5. SQL now correctly processes the ON clause in these cases.

7.2.8 SET EXECUTE Now Implicitly Executed When ROLLBACK Question Is Asked

In prior versions of Oracle Rdb, Interactive SQL would ask if you wished to ROLLBACK any changes made to the database prior to exiting. However, if the command SET NO EXECUTE had previously been executed, any such ROLLBACK was ignored. With this release of Rdb, a SET EXECUTE is implicitly executed before returning control back to Interactive SQL. Therefore, any commands executed to terminate the session will be executed.

The following example shows this.

```
SQL> set no execute;
SQL>
SQL> select * from tt;
0 rows selected
SQL> exit
There are uncommitted changes to this database.
Would you like a chance to ROLLBACK these changes (No)? y
SQL> select * from tt;
           A
        NULL
1 row selected
SQL> rollback;
```

7.2.9 Unexpected Bugcheck When Accessing View Changed Using the ALTER VIEW Statement

In prior releases of Oracle Rdb, the ALTER VIEW command may set the column RDB$DBKEY_LENGTH in the system table RDB$RELATIONS to the wrong value. This may lead to a bugcheck with a footprint similar to the one shown here.

- SYSTEM−F−ACCVIO, access violation
- Exception occurred at RDMSHRP721\RDMS$$PRE_EXECUTION + 000002F1
- Called from RDMSHRP721\RDMS$$COMPILE_FOR_IF + 00004340
- Called from RDMSHRP721\RDMS$$COMPILE_STMT + 000014C0
- Called from RDMSHRP721\RDMS$$COMPILE_STMT + 00000440

The VIEW definition can be removed using the DROP VIEW statement and then recreated using the CREATE VIEW statement, or you can repeat the ALTER VIEW statement after this release has been installed.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.2.10 Unexpected CAPTIVEACCT Error When Using Spawn Directive in Interactive SQL for RESTRICTED Accounts

Bug 10353927

In prior releases of Oracle Rdb, an account marked as RESTRICTED was not permitted to execute the SPAWN directive in Interactive SQL. The result is shown in the following example:

```
SQL> $ show time
%COSI−F−CAPTIVEACCT, captive account − can't create sub−process
SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5. Interactive SQL no longer treats the OpenVMS UAF flags CAPTIVE and RESTRICTED as identical. As described by the OpenVMS documentation, a RESTRICTED account may still access DCL. This change brings interactive SQL into conformance with other OpenVMS utilities such as MAIL or EDIT/TPU which allow SPAWN actions.

7.2.11 Unexpected NOTRIGRTN Error When Trigger Calls a Procedure Using LOCK TABLE Statement

Bug 11789653

In prior releases of Oracle Rdb, attempts to create a trigger that called a stored procedure which used the LOCK TABLE statement would fail with the error NOTRIGRTN "this stored routine may not be called from a trigger". The following example shows this problem.

```
SQL> create module MY_MODULE
cont>     language      SQL
cont>
cont>     procedure MY_PROC
cont>           (in :IN_ID CHAR(5)
cont>           );
cont>     begin
cont>     declare :EMP_ID CHAR(5);
cont>
cont>     lock table SALARY_HISTORY for PROTECTED WRITE mode;
cont>
cont>     for :EMP_REC
cont>          as each row of table cursor EMP_CURSOR for
cont>             select EMPLOYEE_ID, LAST_NAME, FIRST_NAME
cont>             from EMPLOYEES
cont>             where EMPLOYEE_ID = :IN_ID
cont>     do
cont>         set :EMP_ID = :EMP_REC.EMPLOYEE_ID;
cont>         insert into SALARY_HISTORY
cont>            values (:EMP_ID, 100.00, current_timestamp, null);
cont>     end for;
cont>     end;
cont> end module;
SQL>
SQL> create trigger DEGREE_UPDATE
cont>     after UPDATE of DEGREE on DEGREES
cont>     referencing OLD as ODEG NEW as NDEG
cont>     (call MY_PROC (NDEG.EMPLOYEE_ID))
cont>     for each row;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDB-E-RTN_FAIL, routine "MY_PROC" failed to compile or execute successfully
-RDMS-E-NOTRIGRTN, this stored routine may not be called from a trigger
SQL>
```

The only statements which should cause this error are: SET TRANSACTION, START TRANSACTION, COMMIT, COMMIT AND CHAIN, ROLLBACK and ROLLBACK AND CHAIN.

This problem has been corrected in Oracle Rdb Release 7.2.5. However, the procedure which references the LOCK TABLE statement will need to be recreated before it can be referenced by the trigger definition.

7.2.12 Unexpected Bugchecks When Some Undocumented Syntax Used

Bugs 3949015, 7413895, and 7655283

In prior releases of Oracle Rdb, the incomplete and undocumented SIMILAR TO operator generated a bugcheck when used. This prototype code was erroneously included in the production release.

This problem has been corrected in Oracle Rdb Release 7.2.5. References will now generate a WISH_LIST error.

```
SQL> select * from employees where last_name similar to 'S[a-z]*';
%RDB-F-WISH_LIST, feature has not been implemented
SQL>
```

7.2.13 Unexpected Slow Performance for Query Using SQL Functions

Bug 9112403

In prior releases of Oracle Rdb, a query might exhibit slow performance on the first execution in a session. This occurred when a SQL function was called that contained only constant literal arguments, for instance, TO_DATE('20080625194943','YYYYMMDDHH24MISS'). In such cases, the function has not been compiled and therefore cannot be used to resolve column value for the optimizer. Rdb would then assume that the function was NOT DETERMINISTIC and thus execute the function for every row in the table. Subsequent executions of the same or similar query would perform better because the function, now compiled, could be removed from the main loop and executed just once.

This problem has been corrected in Oracle Rdb Release 7.2.5. The Oracle Rdb query compiler now pre-processes queries to extract and compile any referenced SQL functions. This allows their execution during the compile phase for the query.

A workaround to this problem for older releases is to perform a simple query to load and compile the function prior to execution of the main query, as in the following example.

```
EXEC SQL
    begin
    declare :dt date;
    set :dt = TO_DATE('20080625194943','YYYYMMDDHH24MISS');
    end;
```

7.3 RDO and RDML Errors Fixed

7.3.1 Duplicate Values Generated For IDENTITY Column When RDO Interface Used For STORE

Bug 11804365

In prior releases of Oracle Rdb, it was possible that an RDBPRE (RDO) application would insert duplicate values for an IDENTITY column.

The following example shows that a STORE statement nested in a FOR loop was treated as a single statement when generating the IDENTITY sequence's next value (NEXTVAL). Naturally, neither RDO nor RdbPRE Pre−compiler establish SQL semantics.

```
RDO> for o in OUTER_T
cont>     store i in INNER_T using
cont>         i.tag = 1
cont>     end_store
cont>     store i in INNER_T using
cont>         i.tag = 2
cont>     end_store
cont> end_for
RDO>
RDO> for i in INNER_T
cont>     print i.ident_column, i.tag
cont> end_for
 IDENT_COLUMN           TAG
            1             1
            1             2
RDO>
```

However, the definition of an IDENTITY column is independent of the interface used and should be evaluated for each STORE statement.

This problem has been corrected in Oracle Rdb Release 7.2.5. Oracle Rdb now detects that an IDENTITY sequence is used by a STORE statement and updates it correctly.

Note

Semantics described for the SQL language related to sequences are not present in the RDO language. Therefore, an RDO or RdbPRE Pre−compiler application may not behave in the same way as a similar SQL, SQL Module Language, or SQL Pre−compiler application. For instance, a table that has an AUTOMATIC INSERT AS column that evaluates a sequence's NEXTVAL will not be updated within a similar FOR loop to the example shown above.

7.4 RMU Errors Fixed

7.4.1 RMU/UNLOAD to XML Does Not Replace Special Characters

Bug 9597122

When using RMU/UNLOAD to create an XML file, certain special characters were being inserted as the actual character, not as an XML special character sequence. These special characters include & < > ' and ".

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.2 RMU/RESTORE Could Fail When /BLOCKS_PER_PAGE Was Specified

Bug 8869988

The /BLOCKS_PER_PAGE qualifier can be specified with the Oracle Rdb RMU/RESTORE command to specify a new page size for a database storage area. There was a problem where the restore of a uniform storage area could fail when a new /BLOCKS_PER_PAGE value was specified. The logical area page clump lists on the uniform area spam pages could be corrupted when a new BLOCKS_PER_PAGE value was specified. Pages could be assigned to the wrong logical area in a page clump list if RMU/RESTORE tried to change the clumps per page value on the spam pages in the uniform area based on the new page size. For the RMU/RESTORE of uniform areas, the spam page clumps per page value cannot be changed during an RMU/RESTORE.

This problem resulted in error messages during the restore due to pages being assigned to the wrong logical areas as well as fatal errors and bugcheck dumps due to the invalid spam pages. An RMU/VERIFY of the uniform storage areas would also report logical area errors due to the spam page corruption.

This problem has been fixed. Now if a new BLOCKS_PER_PAGE value is specified for the RMU/RESTORE of a uniform storage area, RMU/RESTORE will never change the clumps per page value for the SPAM pages in that area. Also, new checks have been added to RMU/RESTORE to return an error and terminate an RMU/RESTORE at the start of the restore if a new BLOCKS_PER_PAGE value is specified for a uniform area that would cause database corruption. The user can then repeat the RMU/RESTORE either without specifying a new BLOCKS_PER_PAGE value or by specifying a BLOCKS_PER_PAGE value which RMU/RESTORE will accept since it will not cause database corruption of the uniform storage area.

The following example shows the problem. RMU/RESTORE would put out logical area diagnostics for the logical areas in uniform storage areas for which a new BLOCKS_PER_PAGE value was specified and a fatal error would usually result which could vary but would be related to the corrupted spam pages. Usually a fatal error would result in a bugcheck dump file being created. Note that this problem only happened if RMU/RESTORE decided to change the spam page clumps per page value based on the new blocks per page value, otherwise the restore succeeded and did not put out logical area errors or corrupt the spam pages.

```
$ RMU/RESTORE/LOG/NOCDD/NORECOVER/DIR=SYS$DISK:[] -
  /OPTIONS=SYS$INPUT TEST_DATABASE.RBF
```

```
AREA1/BLOCKS_PER_PAGE=16
AREA2/BLOCKS_PER_PAGE=16
%RMU-I-AIJRSTBEG, restoring after-image journal "state" information
%RMU-I-AIJRSTEND, after-image journal "state" restoration complete
%RMU-I-RESTXT_00, Restored root file
  DISK:[DIRECTORY]TEST_DATABSE.RDB;1
%RMU-I-RESTXT_18, Processing options file SYS$INPUT
area1/blocks_per_page=16
 area1/blocks_per_page=16
area2/blocks_per_page=16
 area2/blocks_per_page=16
%RMU-I-RESTXT_21, Starting full restore of storage area
 (RDB$SYSTEM) DISK:[DIRECTORY]SYS.RDA;1
  at 24-JUN-2010 15:48:24.05
%RMU-I-RESTXT_21, Starting full restore of storage area
 (AREA1) DISK:[DIRECTORY]AREA1.RDA;1
  at 24-JUN-2010 15:48:24.18
%RMU-W-BADPTLARE, invalid larea for uniform data page 5 in storage
area 8
%RMU-W-BADPTLAR2,                   SPAM larea_dbid: 97, page
larea_dbid: 117
%RMU-W-BADPTLARE, invalid larea for uniform data page 11 in storage
area 8
%RMU-W-BADPTLAR2,                   SPAM larea_dbid: 97, page
larea_dbid: 117
%RMU-W-BADPTLARE, invalid larea for uniform data page 719 in storage
area 8
%RMU-W-BADPTLAR2,                   SPAM larea_dbid: 117, page
larea_dbid: 97
%RMU-I-RESTXT_24, Completed full restore of storage area (RDB$SYSTEM)
DISK:[DIRECTORY]SYS.RDA;1 at 24-JUN-2010 15:48:26.49
%RMU-I-RESTXT_24, Completed full restore of storage area (AREA1)
DISK:[DIRECTORY]PMR_DATA.RDA;1 at 24-JUN-2010 15:48:40.03
%SYSTEM-F-ROPRAND, reserved operand fault at PC=00000000802C1642,
PS=0000001B
%RMU-I-BUGCHKDMP, generating bugcheck dump file
DISK:[DIRECTORY]RMUBUGCHK.DMP;
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 24-JUN-2010
15:48:43.18
```

The following example shows the new error messages which can now be returned if a BLOCKS_PER_PAGE value is specified with the RMU/RESTORE command which will cause database corruption for a uniform storage area.

```
$ RMU/RESTORE/LOG/NOCDD/NORECOVER/DIR=SYS$DISK:[]-
 DISK:[DIRECTORY]TEST_DATABASE.RBF -
AREA1/BLOCKS_PER_PAGE=63, AREA2/BLOCKS_PER_PAGE=63
RMU-I-AIJRSTBEG, restoring after-image journal "state" information
%RMU-I-AIJRSTEND, after-image journal "state" restoration complete
%RMU-I-RESTXT_00, Restored root file
 DISK:[DIRECTORY]TEST_DATABASE.RDB;1
%RMU-W-CLMPPGCNT, the clump page count multiplied by the number of
  blocks
%RMU-W-CLMPPGCN2,                   per page is greater than the
  maximum of 64 blocks
  %RMU-W-CLMPPGCN3,                   Computed: 189. CLUMP_PAGCNT = 3;
  PAG_BLKCNT = 63
%RMU-F-BDCLMPPGCNT, The specified BLOCKS_PER_PAGE value would cause
  an illegal clump page count for storage area
  DISK:[DIRECTORY]AREA1.RDA;1
```

```
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at  2-JUL-2010
 14:07:03.74
$ RMU/RESTORE/LOG/NOCDD/NORECOVER/DIR=SYS$DISK:[] -
  /OPTIONS=SYS$INPUT DISK:[DIRECTORY]MFP.RBF
MF_PERS_SEGSTR/BLOCKS_PER_PAGE=8
%RMU-I-AIJRSTBEG, restoring after-image journal "state" information
%RMU-I-AIJRSTEND, after-image journal "state" restoration complete
%RMU-I-RESTXT_00, Restored root file
 DISK:[DIRECTORY]MF_PERSONNEL.RDB;1
  %RMU-I-RESTXT_18, Processing options file SYS$INPUT
MF_PERS_SEGSTR/blocks_per_page=8
 MF_PERS_SEGSTR/blocks_per_page=8
%RMU-F-BUFSMLPAG, The specified BLOCKS_PER_PAGE 8 exceeds the
 buffer size 6 for storage area
 DISK:[DIRECTORY]MF_PERS_SEGSTR.RDA;1
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at  2-JUL-2010
 14:36:52.26
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.3 An Incremental Instead Of a Full Backup Could Corrupt a Database

Bug 10021340

As documented in the Oracle Rdb Guide To Database Maintenance (see sections 7.5.2 and 7.5.3), a full database backup, not an incremental backup, should be done after changing the physical and logical design of an Oracle Rdb database. This includes major changes made to the structures of the database with the SQL ALTER DATABASE statement. If an incremental backup is done instead of a full backup in such cases, database corruption can occur when the incremental restore is later executed on the database.

Instead of just recommending in our documentation doing a full database backup in these cases to prevent database corruption, we now will return an error and not execute the incremental backup if an incremental backup instead of a full database backup is executed following certain major changes to the database that could result in database corruption when the incremental restore is later executed. This will protect the integrity of the database.

The following message will be output in such cases when the incremental backup is attempted.

```
$ RMU/BACKUP/INCREMENTAL/NOLOG MF_PERSONNEL MFP.RBF
%RMU-F-NOFULLBCK, no full backup of this database exists
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 19-AUG-2010
 17:17:07.03
```

The user should then do a full backup of the database. Note that the incremental backup will not be allowed only in certain cases where major changes to the database have been made which could cause database corruption later when the incremental restore is applied to the database. Once a full backup has been done in such cases, subsequent incremental backups will succeed.

The following example shows one specific instance of the problem. In this particular case, a storage area N3 was added to the database FOO after the full database backup and then an incremental backup was done instead of a full backup. This caused database corruption when the incremental restore was later applied to the FOO database.

```
$ set def DIR1:[A1]
$ SQL
create data file foo
reserve 10 storage area
create storage area n1
create storage area n2
create storage area n4;
create table t11 (i1 int);
create storage map m11 for t11 store in n4;
insert into t11 values (123);
 1 row inserted
commit;
disconnect all;
alter data file foo drop storage area n2;
exit;
$ rmu/backup/nolog foo.rdb f1.rbf
$ SQL
alter data file foo
add storage area n3;
att 'fi foo';
create table t1 (i1 int);
create storage map m1 for t1 store in n3;
insert into t1 values (123);
1 row inserted
commit;
exit;
$ rmu/backup/incremental/nolog foo.rdb f2.rbf
$ set def DIR2:[A2]
$ rmu/restore/nocdd/noafter/norec/nolog/dir=dir2:[a2] -
  dir1:[a1]f1.rbf
$ rmu/restore/nocdd/log/norec/incremental/noconf/dir=dir2:[a2] -
  dir1:[a1]f2.rbf
%RMU-I-RESTXT_00, Restored root file DIR2:[A2]FOO.RDB;1
%RMU-I-RESTXT_22, Starting incremental restore of storage area
 (RDB$SYSTEM) DIR2:[A2]FOO.RDA;1 at 12-AUG-2010 11:05:10.16
%RMU-I-RESTXT_22, Starting incremental restore of storage area (N4)
 DIR2:[A2]N4.RDA;1 at 12-AUG-2010 11:05:10.16
%RMU-I-RESTXT_22, Starting incremental restore of storage area (N3)
 DIR2:[A2]N3.RDA;1 at 12-AUG-2010 11:05:10.17
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
address=FFFFFFFFEB6BA336, PC=00000000003A0434, PS=0000001B
%RMU-I-BUGCHKDMP, generating bugcheck dump file
 SERDB_USER1:[HOCHULI]RMUBUGCHK.DMP;
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 12-AUG-2010
 11:05:10.28
$ rmu/verify/all foo.rdb
%RMU-F-INV_ROOT, database file has illegal format
%RMU-F-FTL_VER, Fatal error for VERIFY operation at 12-AUG-2010
 11:05:10.32
```

The following example shows the new behavior using the above example. When the incremental backup is attempted after the storage area is added, the incremental backup is not executed and the RMU-F-NOFULLBCK error message is output because a full backup is required in this case. When the user then does a full backup it succeeds. The user later does a full restore instead of a full restore followed by an incremental restore and no corruption of the database occurs.

```
$ set def DIR1:[A1]
$ SQL
create data file foo
reserve 10 storage area
```

```
create storage area n1
create storage area n2
create storage area n4;
create table t11 (i1 int);
create storage map m11 for t11 store in n4;
insert into t11 values (123);
 1 row inserted
commit;
disconnect all;
alter data file foo drop storage area n2;
exit;
$ rmu/backup/nolog foo.rdb f1.rbf
$ SQL
alter data file foo
add storage area n3;
att 'fi foo';
create table t1 (i1 int);
create storage map m1 for t1 store in n3;
insert into t1 values (123);
1 row inserted
commit;
exit;
$ rmu/backup/incremental/nolog foo.rdb f2.rbf
%RMU-F-NOFULLBCK, no full backup of this database exists
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 12-AUG-2010
 11:04:07.03
$ rmu/backup/nolog foo.rdb f2.rbf
$ set def DIR2:[A2]
$ rmu/restore/nocdd/nolog/norec/noconf/dir=dir2:[a2] -
  dir1:[a1]f2.rbf
$ rmu/verify/all foo.rdb
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.4 RMU/BACKUP/AFTER Invalid Open Record With Emergency AIJ Files

Bug 8943703

If RMU/BACKUP/AFTER was being executed to back up fixed AIJ files at a time when there was an extremely heavy load on an Oracle Rdb database which caused the existing AIJ files to fill up so that additional emergency fixed AIJ files had to be created and frequent switching between AIJ files was taking place, an invalid OPEN record with an invalid sequnce number of "−1" and other incorrect fields could be created in the backup AIJ file for one of the non−emergency AIJ files that was backed up. If the backed up AIJ file was used later for an RMU/RECOVER of the database, the invalid sequence number would cause the recovery to fail. Note that the invalid OPEN record was created in the backed up AIJ file, not in the live fixed AIJ files.

This problem is fixed in Oracle Rdb Release 7.2.4.0 and all later 7.2.4 releases but was not documented in previous 7.2.4 release notes. It happened because a flag in the database root for each AIJ file which indicates that the AIJ file is currently being backed up, was being cleared too soon. This flag is checked by the AIJ server code when switching between files and for other operations. If the fixed AIJ files were being heavily used during the backup, this set up a small time window when the sequence number of the OPEN record of the AIJ file currently being backed up could be reset to −1, to indicate that the AIJ file was not being currently used, just before RMU/BACKUP/AFTER read the AIJ file OPEN record and copied it to the backup AIJ file.

The following shows an example of the invalid open record when the AIJ backup file created by the RMU/BACKUP/AFTER command was dumped.

```
$ RMU/BACKUP/AFTER_JOURNAL/NOLOG/NOQUIET mf_personnel.rdb mfpaipbck
$ RMU/DUMP/AFTER/NODATA/OUT=DUMP.LIS mfpaipbck
$ TYPE DUMP.LIS

60494/131589     TYPE=O, LENGTH=510, TAD=19-JUL-2010 14:35:51.53,
CSM=00

Database DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
Database timestamp is 19-JUL-2010 11:02:31.47
Facility is "RDMSAIJ ", Version is 721.0
Database version is 72.1
AIJ Sequence Number is -1
Last Commit TSN is 0:0
Synchronization TSN is 0:0
Journal created on VMS platform
Type is Normal (unoptimized)
Open mode is Initial
Journal was backed up on19-JUL-2010 14:35:49.15
Backup type is No-Quiet-Point
I/O format is Block
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.5 RMU/COLLECT OPTIMIZER Invalid Cardinality With Vertical Record Partitioning

When the Oracle Rdb RMU/COLLECT OPTIMIZER command collected table cardinality statistics for tables with VERTICAL RECORD PARTITIONING, where table column values are assigned to different storage areas using a storage map, the cardinality was incorrectly incremented for each column partition. This caused the cardinality statistic for that table to be too large and also caused any statistics calculated using that cardinality value to be incorrect, such as the Row Clustering Factor. This has been fixed and the cardinality and related statistics will now be correct for tables with vertical record partitioning.

The following shows an example of the problem. The table T1 in the Rdb FOO database is defined with vertical record (column) partitioning. When the RMU/COLLECT OPTIMIZER command was run to collect statistics for the database, an incorrect table cardinality (5 instead of 1) and an incorrect table row clustering factor (3 instead of 15) were calculated for table T1. The row clustering factor was incorrect because it was calculated based on the incorrect table cardinality.

```
$ SQL
        CREATE DATA FILE FOO
                CREATE STORAGE AREA A1 FILE A1
                CREATE STORAGE AREA A2 FILE A2
                CREATE STORAGE AREA A3 FILE A3
                CREATE STORAGE AREA A4 FILE A4
                CREATE STORAGE AREA A5 FILE A5;
        CREATE TABLE T1 (C1 INT, C2 INT, C3 INT, C4 INT, C5 INT);
        CREATE STORAGE MAP M1 FOR T1
                STORE COLUMNS (C1) IN A1
                STORE COLUMNS (C2) IN A2
                STORE COLUMNS (C3) IN A3
                STORE COLUMNS (C4) IN A4
                STORE COLUMNS (C5) IN A5;
```

```
        INSERT INTO T1 VALUES (1,2,3,4,5);
1 row inserted
        COMMIT;
        EXIT;
$ RMU/COLLECT OPTIMIZER FOO.RDB
Start loading tables... at  8-SEP-2010 11:44:28.31
Done loading tables.... at  8-SEP-2010 11:44:28.33
Start loading indexes... at  8-SEP-2010 11:44:28.33
Done loading indexes.... at  8-SEP-2010 11:44:28.33
Start collecting btree index stats... at  8-SEP-2010 11:44:28.37
Done collecting btree index stats.... at  8-SEP-2010 11:44:28.37
Start collecting table & hash index stats... at  8-SEP-2010 11:44:28.37
Done collecting table & hash index stats.... at  8-SEP-2010 11:44:28.37
Start collecting workload stats... at  8-SEP-2010 11:44:28.45
Maximum memory required (bytes) = 0
Done collecting workload stats.... at  8-SEP-2010 11:44:28.45
Start calculating stats... at  8-SEP-2010 11:44:28.46
Done calculating stats.... at  8-SEP-2010 11:44:28.46
Start writing stats... at  8-SEP-2010 11:44:28.49

-------------------------------------------------------------------------------

Optimizer Statistics collected for table : T1

  Cardinality            : 5
  Row clustering factor  : 3.0000000
Done writing stats.... at  8-SEP-2010 11:44:28.51
```

The following example shows that this problem has been fixed. The table T1 in the Rdb FOO database is defined with vertical record (column) partitioning. When the RMU/COLLECT OPTIMIZER command is run to collect statistics for the database, a correct table cardinality (1) and a correct table row clustering factor (15) are calculated for table T1.

```
$ SQL
        CREATE DATA FILE FOO
                CREATE STORAGE AREA A1 FILE A1
                CREATE STORAGE AREA A2 FILE A2
                CREATE STORAGE AREA A3 FILE A3
                CREATE STORAGE AREA A4 FILE A4
                CREATE STORAGE AREA A5 FILE A5;
        CREATE TABLE T1 (C1 INT, C2 INT, C3 INT, C4 INT, C5 INT);
        CREATE STORAGE MAP M1 FOR T1
                STORE COLUMNS (C1) IN A1
                STORE COLUMNS (C2) IN A2
                STORE COLUMNS (C3) IN A3
                STORE COLUMNS (C4) IN A4
                STORE COLUMNS (C5) IN A5;
        INSERT INTO T1 VALUES (1,2,3,4,5);
1 row inserted
        COMMIT;
        EXIT;
$ RMU/COLLECT OPTIMIZER FOO.RDB
Start loading tables... at  8-SEP-2010 11:45:16.63
Done loading tables.... at  8-SEP-2010 11:45:16.69
Start loading indexes... at  8-SEP-2010 11:45:16.69
Done loading indexes.... at  8-SEP-2010 11:45:16.69
Start collecting btree index stats... at  8-SEP-2010 11:45:16.89
Done collecting btree index stats.... at  8-SEP-2010 11:45:16.89
Start collecting table & hash index stats... at  8-SEP-2010 11:45:16.89
Done collecting table & hash index stats.... at  8-SEP-2010 11:45:16.90
Start collecting workload stats... at  8-SEP-2010 11:45:17.01
```

```
Maximum memory required (bytes) = 0
Done collecting workload stats.... at  8-SEP-2010 11:45:17.02
Start calculating stats... at  8-SEP-2010 11:45:17.02
Done calculating stats.... at  8-SEP-2010 11:45:17.02
Start writing stats... at  8-SEP-2010 11:45:17.06

--------------------------------------------------------------------------------

Optimizer Statistics collected for table : T1

  Cardinality            : 1
  Row clustering factor  : 15.0000000
Done writing stats.... at  8-SEP-2010 11:45:17.07
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.6 RMU /RECOVER /ORDER_AIJ May Remove Required Journal Files

Bug 10020166

In certain cases, it was possible for the /ORDER_AIJ qualifier on the RMU/RECOVER command to reject (or "prune") required journals from the input journal list. This would most likely happen when all the following occurred:

- Performed an RMU /RECOVER using After−Image Journal (AIJ) backups;
- Recovered only a subset of the required journals;
- The last journal applied had unresolved or incomplete transactions;

For example, suppose a database needed to be recovered, starting at AIJ VNO 10 using the following AIJ backup journal files:

```
J1.AIJ (aij quiet_point backup)   : OPEN_VNO=10, QUIET_VNO=10
J2.AIJ (aij noquiet_point backup) : OPEN_VNO=11, QUIET_VNO=10
J3.AIJ (aij noquiet_point backup) : OPEN_VNO=12, QUIET_VNO=11
J4.AIJ (aij quiet_point backup)   : OPEN_VNO=13, QUIET_VNO=13
```

STEP 1) The DBA issues:

```
$ RMU/RECOVER/ORDER_AIJ/ROOT=MF_PERSONNEL J1,J2
```

Journals J1.AIJ (OPEN_VNO=10) and J2.AIJ (OPEN_VNO=11) are applied and the database root is updated to show that RCVR_VNO 12 is the next journal to be applied. However, J2 had potentially unresolved transactions since it was not closed at a quiet_point.

STEP 2) The DBA next issues:

```
$ RMU/RECOVER/ORDER_AIJ/ROOT=MF_PERSONNEL J3,J4
```

Since J3 (OPEN_VNO=12, QUIET_VNO=11) does not start at a quiet_point, recovery terminates with an error:

```
RMU-F-AIJNORCVR, recovery must start with journal sequence 11
```

STEP 3) The DBA next issues:

```
$ RMU/RECOVER/ORDER_AIJ/ROOT=MF_PERSONNEL J1,J2,J3,J4
```

Normally, this would have been the optimal command for the recovery in this case but since the root had been previously updated to show that VNO 12 is required to start recovery, /ORDER_AIJ would prune J1 and J2 and only attempt to recover journals J3 and J4, which would result in the same error as in STEP 2 above.

The workaround would be to not use /ORDER_AIJ when recovering with such a strategy.

This problem has been corrected in Oracle Rdb Release 7.2.5. Now when the DBA attempts STEP 1, the root's OPEN_VNO will not be updated past the last known QUIET_POINT (VNO 10, in this case).

Note

When using AIJ backups for recovery, RMU/RECOVER must begin with a QUIET_POINT backup. Oracle recommends that recovery terminate with an AIJ backup that was closed at a QUIET_POINT (i.e. the next journal backed up was created by a QUIET_POINT backup).

7.4.7 RMU/CONVERT Fails to Convert Databases With Database−wide Collating Sequence

Bug 10125553

In prior versions of Oracle Rdb, it was possible that databases created with a database−wide collating sequence would not be converted correctly to Oracle Rdb V7.2.

The following example shows the problem where the database was created using the following definition:

```
create database
     filename BAD
     protection is ACL
     collating sequence GERMAN
;
disconnect all;
```

The RMU/CONVERT would proceed in a similar manner to the following example.

```
$ RMU/CONVERT BAD /NOCONFIRM
%RMU−I−RMUTXT_000, Executing RMU for Oracle Rdb V7.2−411 on OpenVMS Alpha
V8.3−1H1
%RMU−I−LOGCONVRT, database root converted to current structure level
%RMU−S−CVTDBSUC, database USER1:[TESTING]BAD.RDB;1 successfully converted from
version V7.1 to V7.2
%RMU−I−CVTCOMSUC, CONVERT committed for USER1:[TESTING]BAD.RDB;1 to version V7.2
%RDB−E−OBSOLETE_METADA, request references metadata objects that no longer exist
−RDMS−F−RELNOEXI, relation RDB$DATABASE does not exist in this database
%RDB−E−OBSOLETE_METADA, request references metadata objects that no longer exist
−RDMS−F−RELNOEXI, relation RDB$DATABASE does not exist in this database
```

If this occurs, Oracle recommends restoring the database from backup and using SQL EXPORT DATABASE and IMPORT DATABASE under Rdb V7.2, or installing this corrected version prior to performing RMU/CONVERT.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.8 RMU/CONVERT/NOCOMMIT Did Not Call "Fix Up" Routine at End of Conversion

Bug 10145825

The Oracle Rdb RMU/CONVERT/NOCOMMIT command converts an Rdb database from an older version of Rdb to a newer version of Rdb but retains the original metadata as well as the converted metadata so that later the user can either execute the RMU/CONVERT/COMMIT command to finalize the conversion by deleting the original metadata or return the database metadata to the original version of Rdb by executing the RMU/CONVERT/ROLLBACK command.

However, there was a problem where RMU/CONVERT/NOCOMMIT did not attach to the database once it had been converted and call a routine to fully complete the metadata conversion. This routine has always been called by RMU/CONVERT/COMMIT. This problem has been fixed and now RMU/CONVERT/NOCOMMIT will also attach to the database and call this routine to fully complete the metadata conversion.

Because RMU/CONVERT/NOCOMMIT did not call a routine to fully complete the metadata conversion, the following problems could occur.

- For Multischema databases, access to new system tables could fail because the new system tables were not added to the schema mapping table.
- Constraint type information, which would allow easier database queries and future query optimizations, would not be propagated from RDB$RELATION_CONSTRAINTS to RDB$CONSTRAINTS.
- If the database was used for Replication Option for Rdb, an index might not be added to improve performance (RDB$TRAN_RELS_REL_NAME_NDX on table RDB$TRANSFER_RELATIONS).
- A file level ACL might not be added or modified to enable RMU access to the database.

The following shows an example of the problem. The Rdb logical RDMS$SET_FLAGS is defined to see if an attach to the database is being done at the end of the conversion to call the routine to finalize the metadata conversion. The output shows that no attach to the database is being executed.

```
$ DEFINE RDMS$SET_FLAGS "DATABASE"
$ RMU/CONVERT/NOCOMMIT MF_PERSONNEL
%RMU-I-RMUTXT_000, Executing RMU for Oracle Rdb V7.2-410 on OpenVMS
 Alpha V8.4
Are you satisfied with your backup of
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 and your backup of
 any associated .aij files [N]? Y
%RMU-I-LOGCONVRT, database root converted to current structure level
%RMU-S-CVTDBSUC, database
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 successfully
 converted from version V7.1 to V7.2
```

The following example shows that this problem has been fixed. Again, the Rdb logical RDMS$SET_FLAGS is defined to see if an attach to the database is being done at the end of the conversion to call the routine to finalize the metadata conversion. The output now shows that the attach to the database is being executed.

```
$ DEFINE RDMS$SET_FLAGS "DATABASE"
$ RMU/CONVERT/NOCOMMIT MF_PERSONNEL
%RMU-I-RMUTXT_000, Executing RMU for Oracle Rdb V7.2-501 on OpenVMS
 Alpha V8.4
Are you satisfied with your backup of
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 and your backup of
 any associated .aij files [N]? Y
%RMU-I-LOGCONVRT, database root converted to current structure level
%RMU-S-CVTDBSUC, database
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 successfully
 converted from version V7.1 to V7.2
 ATTACH #1, Database
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
 ~P Database Parameter Buffer (version=2, len=62)
 0000 (00000) RDB$K_DPB_VERSION2
 0001 (00001) RDB$K_FACILITY_ALL
 0002 (00002) RDB$K_DPB2_IMAGE_NAME
 "NODE::DEVICE:[DIRECTORY]RMU72.EXE"
 003A (00058) RDB$K_FACILITY_RDB_VMS
 003B (00059) RDB$K_DPB2_CHECK_ACCESS
 RDMS$BIND_WORK_FILE =
  "DEVICE:[DIRECTORY]RDMSTTBL$UN71RK1V4IA10EJ17T80.TMP;"
 (Visible = 0)
 DETACH #1
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.9 Problems Validating Files Specified in the "/AIJ_OPTIONS" File

Bug 10327835

Insufficient user privileges or invalid file device and directory specifications cause fatal file creation errors for AIJ related files contained in the options file specified by the "/AIJ_OPTIONS" qualifier used with the Oracle Rdb RMU "RMU/RESTORE", "RMU/RESTORE/ONLY_ROOT", "RMU/MOVE_AREA" and "RMU/COPY_DATABASE" commands.

However, these fatal file creation problems were not detected at the start of command execution when the options file specified by the "/AIJ_OPTIONS" qualifier is parsed but at the end of command execution at the time the AIJ related files specified in the "/AIJ_OPTIONS" file are actually created. Therefore, even though a fatal error was finally put out and the command was aborted, it was possible for an accessible Rdb database root file to be created pointing to the wrong AIJ file specification from the original Rdb database root instead of the AIJ file specification specified in the "/AIJ_OPTIONS" file.

This problem has been corrected in Oracle Rdb Release 7.2.5. Now these fatal AIJ file and AIJ backup file creation problems are detected at the start of the RMU command execution, immediately after the AIJ options file is parsed, so no invalid database files are created and a true abort of the command execution occurs.

The following example shows the problem. The device and directory "DEVICE:[DIRECTORY.TEST.BOGUS]", specified for the three fixed AIJ files in the options file

"bad_aij.opt" used with the "RMU/RESTORE" command, does not exist. However, this problem was not detected and the restore command was not aborted when the "bad_aij.opt" file was parsed at the start of the command. Instead, the problem was detected and the command was aborted at the end of the command, after all the other database files were restored, at the creation time of the AIJ files specified by the "bad_aij.opt" options file.

```
$ RMU/RESTORE/LOG/NOCDD/AIJ_OPTIONS=BAD_AIJ.OPT -
 /DIRECTORY=DEVICE:[DIRECTORY.TEST.TEST2] -
 /ROOT=DEVICE:[DIRECTORY.TEST.TEST2] MFP.RBF
%RMU-I-RESTXT_18, Processing options file BAD_AIJ.OPT
  JOURNAL IS ENABLED -
      RESERVE 6 -
      ALLOCATION IS 512 -
      EXTENT IS 512 -
      OVERWRITE IS DISABLED -
      SHUTDOWN_TIMEOUT IS 60 -
      NOTIFY IS DISABLED -
      BACKUPS ARE MANUAL -
      CACHE IS DISABLED
  ADD JOURNAL AIJ1 -
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ1.AIJ;1
  !    FILE AIJ1
  ADD JOURNAL AIJ2 -
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ2.AIJ;1
  !    FILE AIJ2
  ADD JOURNAL AIJ3 -
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ3.AIJ;1
  !    FILE AIJ3
%RMU-I-RESTXT_00, Restored root file DEVICE:[DIRECTORY.TEST.TEST2]
MF_PERSONNEL.RDB;1
%RMU-I-RESTXT_21, Starting full restore of storage area (RDB$SYSTEM)
 DEVICE:[DIRECTORY.TEST.TEST2]MF_PERS_DEFAULT.RDA;1 at  4-FEB-2011 12:57:09.20
%RMU-I-RESTXT_21, Starting full restore of storage area (EMPIDS_OVER)
 DEVICE:[DIRECTORY.TEST.TEST2]EMPIDS_OVER.RDA;1 at  4-FEB-2011 12:57:09.21
%RMU-I-RESTXT_24, Completed full restore of storage area (EMPIDS_OVER)
 DEVICE:[DIRECTORY.TEST.TEST2]EMPIDS_OVER.RDA;1 at  4-FEB-2011 12:57:09.22
%RMU-I-RESTXT_24, Completed full restore of storage area (RDB$SYSTEM)
 DEVICE:[DIRECTORY.TEST.TEST2]MF_PERS_DEFAULT.RDA;1 at  4-FEB-2011 12:57:09.44
%RMU-I-RESTXT_01, Initialized snapshot file
 DEVICE:[DIRECTORY.TEST.TEST2]MF_PERS_DEFAULT.SNP;1
%RMU-I-LOGINIFIL,     contains 146 pages, each page is 4 blocks long
%RMU-I-RESTXT_01, Initialized snapshot file
 DEVICE:[DIRECTORY.TEST.TEST2]EMPIDS_OVER.SNP;1
%RMU-I-LOGINIFIL,     contains 10 pages, each page is 4 blocks long
%RMU-I-AIJWASON, AIJ journaling was active when the database was backed up
%RMU-I-AIJRECFUL, Recovery of the entire database starts with
 AIJ file sequence 0
%RMU-F-FILACCERR, error creating after-image journal file
 DEVICE:[DIRECTORY.TEST.BOGUS]AIJ1.AIJ;1
-RMS-E-DNF, directory not found
-SYSTEM-W-NOSUCHFILE, no such file
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at  4-FEB-2011 12:57:09.57
```

The following example shows that this problem has been fixed. Again, the device and directory "DEVICE:[DIRECTORY.TEST.BOGUS]", specified for the three fixed AIJ files in the options file "bad_aij.opt" used with the "RMU/RESTORE" command, does not exist. However, now the problem is detected and the restore command is aborted when the "bad_aij.opt" file is parsed at the start of the command, before any database files have been created.

```
$ RMU/RESTORE/LOG/NOCDD/AIJ_OPTIONS=BAD_AIJ.OPT −
 /DIRECTORY=DEVICE:[DIRECTORY.TEST.TEST2] −
 /ROOT=DEVICE:[DIRECTORY.TEST.TEST2] MFP.RBF
%RMU−I−RESTXT_18, Processing options file BAD_AIJ.OPT
  JOURNAL IS ENABLED −
      RESERVE 6 −
      ALLOCATION IS 512 −
      EXTENT IS 512 −
      OVERWRITE IS DISABLED −
      SHUTDOWN_TIMEOUT IS 60 −
      NOTIFY IS DISABLED −
      BACKUPS ARE MANUAL −
      CACHE IS DISABLED
  ADD JOURNAL AIJ1 −
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ1.AIJ;1
  !    FILE AIJ1
  ADD JOURNAL AIJ2 −
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ2.AIJ;1
  !    FILE AIJ2
  ADD JOURNAL AIJ3 −
   FILE DEVICE:[DIRECTORY.TEST.BOGUS]AIJ3.AIJ;1
  !    FILE AIJ3
%RMU−F−FILACCERR, error creating after−image journal file
 DEVICE:[DIRECTORY.TEST.BOGUS]AIJ1.AIJ;1
−RMS−E−DNF, directory not found
%RMU−F−FTL_RSTR, Fatal error for RESTORE operation at  4−FEB−2011
12:59:17.33
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.10 RMU Online Backup May Store TSNs of Zero

Bug 11769886

When an online RMU Backup operation captures data from a live page that requires searching a snapshot chain to retrieve visible row content, the TSN values written to the backup output would incorrectly be stored as zeros.

In certain cases, a database restored from such a backup may contain incorrect record content and may lead to verification or runtime errors.

This problem has been corrected in Oracle Rdb Release 7.2.5. Correct TSN values are now written to the backup output.

7.4.11 RMU/SET AFTER/AIJ_OPTIONS RMU−F−VALLSMIN Error If "RESERVE 0"

Bug 11741193

The Oracle Rdb RMU "RMU/SET AFTER/AIJ_OPTIONS" command failed with the error "RMU−F−VALLSSMIN, value (0) is less than minimum allowed value (1) for RESERVE" if "RESERVE 0" was specified or no "RESERVE" clause was specified in the AIJ options file. Therefore, even if sufficient AIJ file reservations were already defined for the database, there was no way to avoid reserving additional unneeded space in the after−image journal configuration when the "ADD JOURNAL" clause was used in the

AIJ options file specified by the "RMU/SET AFTER/AIJ_OPTIONS" command.

If the AIJ options file was not used and "RMU/SET AFTER/RESERVE=0" was specified on the command line, or the "/RESERVE" qualifier was not specified on the command line, then RMU/SET AFTER correctly did not reserve additional space in the after−image journal configuration. This is the way the RESERVE clause is supposed to work as specified in the Orace Rdb RMU documentation for the "RMU/SET AFTER" command. If the AIJ file reservations already defined for the database are not sufficient to hold the additional AIJ files added to the after−image journal file configuration by the "ADD JOURNAL" clause, the error "%RMU−F−NOAIJSLOTS, no more after−image journal slots are available" will continue to be output and the "RMU/SET AFTER" command will fail with no changes made to the database AIJ configuration.

This problem has been fixed. Now "RESERVE 0" can be specified in the AIJ options file used with the "RMU/SET AFTER" command or no "RESERVE" clause can be specified. In both cases, no additional space in the after−image journal configuration will be reserved.

The following examples show the problem. Both when no "RESERVE" clause is specified in the AIJ options file and when "RESERVE 0" is specified to indicate that no additional space in the after−image journal configuration should be reserved, the "RMU/SET AFTER" command incorrectly fails with the "%RMU−F−VALLSSMIN" error. Only when a reserve clause with a value greater than zero is specified does the "RMU/SET AFTER" command succeed.

```
$ type aij.opt
JOURNAL IS ENABLED
ADD JOURNAL AIJ1 FILE DEVICE:[DIRECTORY]AIJ1
$ RMU/SET AFTER /AIJ_OPTION=AIJ.OPT MF_PERSONNEL
%RMU−F−VALLSSMIN, value (0) is less than minimum allowed value (1)
 for RESERVE
%RMU−F−FTL_SET, Fatal error for SET operation at 10−FEB−2011
 08:11:46.75
$ type aij.opt
JOURNAL IS ENABLED RESERVE 0
ADD JOURNAL AIJ1 FILE DEVICE:[DIRECTORY]AIJ1
$ RMU/SET AFTER /AIJ_OPTION=AIJ.OPT MF_PERSONNEL
%RMU−F−VALLSSMIN, value (0) is less than minimum allowed value (1)
 for RESERVE
%RMU−F−FTL_SET, Fatal error for SET operation at 10−FEB−2011
 08:11:46.75
$ RMU/SET AFTER /AIJ_OPTION=AIJ.OPT MF_PERSONNEL
%RMU−I−RESTXT_18, Processing options file AIJ.OPT
  JOURNAL IS ENABLED RESERVE 1
  ADD JOURNAL AIJ1 FILE DEVICE:[DIRECTORY]AIJ1
%RMU−I−LOGMODFLG,     disabled after−image journaling
%RMU−I−LOGMODVAL,     reserved 1 additional after−image journals
%RMU−W−DOFULLBCK, full database backup should be done to ensure
 future recovery
%RMU−I−LOGCREAIJ, created after−image journal file
 DEVICE:[DIRECTORY]AIJ1.AIJ;1
%RMU−I−LOGMODSTR,     activated after−image journal "AIJ1"
%RMU−I−LOGMODFLG,     enabled after−image journaling
%RMU−W−DOFULLBCK, full database backup should be done to ensure
 future recovery
```

The following example shows that this problem has been fixed. Both when no "RESERVE" clause is specified in the AIJ options file and when "RESERVE 0" is specified to indicate that no additional space in the after−image journal configuration should be reserved the "RMU/SET AFTER" command succeeds and the "%RMU−I−LOGMODVAL, reserved 1 additional after−image journals" file message does not come out

indicating that no additional space in the AIJ configuration has been reserved but currently available space has been used.

```
$ RMU/SET AFTER /AIJ_OPTION=AIJ.OPT MF_PERSONNEL
%RMU-I-RESTXT_18, Processing options file AIJ.OPT
  JOURNAL IS ENABLED
  ADD JOURNAL AIJ1 FILE DEVICE:[DIRECTORY]AIJ1
%RMU-I-LOGMODFLG,     disabled after-image journaling
%RMU-W-DOFULLBCK, full database backup should be done to ensure
 future recovery
%RMU-I-LOGCREAIJ, created after-image journal file
 DEVICE:[DIRECTORY]AIJ1.AIJ;1
%RMU-I-LOGMODSTR,     activated after-image journal "AIJ1"
%RMU-I-LOGMODFLG,     enabled after-image journaling
%RMU-W-DOFULLBCK, full database backup should be done to ensure
 future recovery
$ RMU/SET AFTER /AIJ_OPTION=AIJ.OPT MF_PERSONNEL
%RMU-I-RESTXT_18, Processing options file AIJ.OPT
  JOURNAL IS ENABLED RESERVE 0
  ADD JOURNAL AIJ1 FILE DEVICE:[DIRECTORY]AIJ1
%RMU-I-LOGMODFLG,     disabled after-image journaling
%RMU-W-DOFULLBCK, full database backup should be done to ensure
 future recovery
%RMU-I-LOGCREAIJ, created after-image journal file
 DEVICE:[DIRECTORY]AIJ1.AIJ;1
%RMU-I-LOGMODSTR,     activated after-image journal "AIJ1"
%RMU-I-LOGMODFLG,     enabled after-image journaling
%RMU-W-DOFULLBCK, full database backup should be done to ensure
 future recovery
```

As indicated above, to avoid this problem in a previous version of Oracle Rdb RMU, either specify a non−zero reserve clause in the AIJ options file or do not use the AIJ options file with the "RMU/SET AFTER" command but use the "/RESERVE" and "/ADD" qualifiers on the command line instead.

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.4.12 RMU/BACKUP/PARALLEL/RESTORE_OPTIONS Was Not Fully Supported

Bug 6767004

The "/RESTORE_OPTIONS" qualifier, when used with the Oracle Rdb RMU "RMU/BACKUP" command, specifies the file specification of an options file that the backup command creates which contains storage area names followed by storage area qualifiers that define the attributes of the storages areas in the database being backed up. This options file can then be edited and specified by the "/OPTIONS" qualifier used with the "RMU/RESTORE" command to change the attributes of these storage areas when the database is restored.

The "/RESTORE_OPTIONS" qualifier did not work properly when used with the "/PARALLEL" qualifier on the "RMU/BACKUP" command line. The "RESTORE_OPTIONS" option was not put in the PLAN file and was therefore never passed to the "Coordinator" process for execution in a multi−process environment. Therefore, if the "RMU/BACKUP/PLAN" command was used to do a parallel backup using the PLAN file, or when the default "/EXECUTE" qualifier was specified with the "RMU/BACKUP/PARALLEL" command, no restore options file was created.

This problem has been fixed. Now when the "/RESTORE_OPTIONS" qualifier is specified on the "RMU/BACKUP/PARALLEL" command line, the entry

```
       Restore_options = file
```

will be added to the PLAN file, where "file" is the valid VMS file specification of the options file specified by the "/RESTORE_OPTIONS = file" qualifier on the command line, and the options file will be created when the PLAN file is executed. If the "/RESTORE_OPTIONS" qualifier is not specified on the command line, the following "place holder" entry in the form of a comment will be put in the PLAN file and no restore options file will be created when the PLAN file is executed.

```
      ! Restore_options = Restore options file
```

The following example shows the problem. When the parallel backup is executed, the "TMP.PLAN" file created does not contain the "RESTORE_OPTIONS" option and the "RES.OPT" restore options file is not created. When the parallel backup is repeated based on the same "TMP.PLAN" file, the "RES.OPT" file is again not created.

```
$ RMU/BACKUP/PARALLEL=EXEC=1/DISK=WRITER=2/THREADS=3-
 /RESTORE_OPTIONS=DEVICE:[DIRCTORY]RES.OPT/EXEC/LIST=TMP.PLAN-
  MF_PERSONNEL [.DIR1]MFP,[.DIR2]
%RMU-I-COMPLETED, BACKUP operation completed at
 2-MAR-2011 15:19:19.40
$ SEAR TMP.PLAN RESTORE_OPTIONS
%SEARCH-I-NOMATCHES, no strings matched
$ DIR *.OPT
%DIRECT-W-NOFILES, no files found
$ RMU/BACKUP/PLAN TMP.PLAN
%RMU-I-COMPLETED, BACKUP operation completed at
 2-MAR-2011 15:30:19.40
$ DIR *.OPT
%DIRECT-W-NOFILES, no files found
```

The following example shows that this problem has been fixed. When the parallel backup is executed, the "TMP.PLAN" file created does contain the "RESTORE_OPTIONS" option and the "RES.OPT" restore options file is created. When the parallel backup is repeated based on the same "TMP.PLAN" file, the "RES.OPT" file is again created.

```
$ RMU/BACKUP/PARALLEL=EXEC=1/DISK=WRITER=2/THREADS=3-
 /RESTORE_OPTIONS=DEVICE:[DIRCTORY]RES.OPT/EXEC/LIST=TMP.PLAN-
  MF_PERSONNEL [.DIR1]MFP,[.DIR2]
%RMU-I-COMPLETED, BACKUP operation completed at
 3-MAR-2011 15:19:19.40
$ SEAR TMP.PLAN RESTORE_OPTIONS
    Restore_options = DEVICE:[DIRECTORY]RES.OPT
$ DIR *.OPT

Directory DEVICE:[DIRECTORY]

RES.OPT;1
$ RMU/BACKUP/PLAN TMP.PLAN
%RMU-I-COMPLETED, BACKUP operation completed at
 3-MAR-2011 15:30:19.40
$ DIR *.OPT

Directory DEVICE:[DIRECTORY]
```

```
RES.OPT;2
```

This problem has been corrected in Oracle Rdb Release 7.2.5.

7.5 LogMiner Errors Fixed

7.5.1 RMU/UNLOAD/AFTER_JOURNAL /STATISTICS With /OUTPUT Information Display

In prior versions of Oracle Rdb, when using the "/STATISTICS" and "/OUTPUT" qualifiers with the RMU/UNLOAD/AFTER_JOURNAL command, the periodic statistics display records (containing the elapsed time, CPU time, IO counts and so on) would be written to SYS$OUTPUT rather than to the output file as specified.

This problem has been corrected in Oracle Rdb Release 7.2.5. The periodic statistics display record is now written to the output file rather than to SYS$OUTPUT.

7.6 Row Cache Errors Fixed

7.6.1 Row Caching Remains Unexpectedly Disabled for a Newly Added Storage Area

Bug 5926180

In prior releases, a DROP STORAGE AREA for an area that was cached would cause row caching for that cache to become disabled. Subsequently, when a new area was added which also referenced that same cache, it remained disabled. An ALTER DATABASE ... ALTER STORAGE AREA ... CACHE USING was required to reenable row caching for that cache.

The following example shows that after the ADD STORAGE AREA, row caching for the area remains disabled.

```
SQL> alter database
cont>     filename KOD_ADD_AREA_CACHE_USING_7_DB
cont>     drop storage area KOD_ADD_AREA_CACHE_USING_7_AREA
cont> ;
SQL> $ rmu/dump/header KOD_ADD_AREA_CACHE_USING_7_DB/out=middle.txt
SQL> $ search middle.txt "Row Caching..."/wind=(0,2)
    Row Caching...
      - Row caching is enabled
      - No row cache is defined for this area

SQL> alter database
cont>     filename KOD_ADD_AREA_CACHE_USING_7_DB
cont>     add storage area KOD_ADD_AREA_CACHE_USING_7_AREA
cont>         page format is MIXED
cont>         cache using BIG_CACHE
cont> ;
SQL> $ rmu/dump/header KOD_ADD_AREA_CACHE_USING_7_DB/out=after.txt
SQL> $ search after.txt "Row Caching..."/wind=(0,2)
    Row Caching...
      - Row caching is enabled
      - No row cache is defined for this area
***************
    Row Caching...
      - Row caching is disabled
      - Row cache ID is 1

SQL>
```

This problem has been corrected in Oracle Rdb Release 7.2.5. The ADD STORAGE AREA command now implicitly enables row caching for the cache specified in the CACHE USING clause.

7.7 RMU Show Statistics Errors Fixed

7.7.1 Stall Statistics (Aggregate Count) In RMU /SHOW STATISTICS Inaccurate

Bug 10016136

In previous versions of Oracle Rdb, the values on the "Stall Statistics (Aggregate Count)" display were incorrectly scaled and were displayed as inaccurate values.

This problem has been corrected in Oracle Rdb Release 7.2.5. The correct scaling factor is now used.

7.7.2 Unexpected ACCVIO When Using RMU/SHOW STATISTICS

Bug 11871974

In prior releases of Oracle Rdb, it was possible to receive an ACCVIO as RMU Show Statistics was returning to DCL. This problem was most likely due to an error freeing virtual memory used during the session. The ACCVIO causes a bugcheck dump to be generated with a footprint similar to the following.

- Itanium OpenVMS 8.3−1H1
- Oracle Rdb Server 7.2.4.1.0
- Got a RMUBUGCHK.DMP
- SYSTEM−F−ACCVIO, access violation, virtual address=FFFFFFFF816F4040
- Exception occurred at RMU72\COSI_MEM_FREE_VMLIST + 00000132
- Called from RMU72\KUT$DISPLAY + 00004DB0
- Called from RMU72\RMU$DISPLAY + 000044E0
- Called from RMU72\RMU$SHOW + 000014D0

This problem has been corrected in Oracle Rdb Release 7.2.5.

Chapter 8
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.5

8.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.5

8.1.1 New FULBCKREQ Message Output When a Full Backup is Required

Bug 18328148

There are some Oracle Rdb database changes that require the next database backup to be a full backup to guarantee correct database recovery using an incremental backup. If an incremental database backup is executed without a preceding full database backup, the incremental backup will be aborted with a fatal error.

```
$ rmu/backup/incremental/nolog mf_personnel.rdb -
  DEVICE:[DIRECTORY]mfp.rbf
%RMU-F-NOFULLBCK, no full backup of this database exists
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 14-MAR-2014 13:45:21.35
```

A dump of the database header will show if this root flag is set.

```
$ rmu/dump/header mf_personnel
*-------------------------------------------------------------------------------
* Oracle Rdb V7.2-55                                    14-MAR-2014 13:45:18.51
*
* Dump of Database header
*     Database: DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
*
*-------------------------------------------------------------------------------
Database Parameters:

    Database Backup...

      - Incremental backup not allowed until full backup
```

A new warning message will now be output at the end of an ALTER DATABASE command if the ALTER DATABASE command contains one or more operations which require the next database backup to be a full database backup.

```
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
```

These are the operations that require the next database backup to be a full database backup.

- Add one or more storage areas to the database.

  ```
  $ SQL$
  alter data filename mf_personnel
    add storage area new_area;
  %RDMS-W-FULBCKREQ, The next database backup must be a full backup
  $
  ```
- Delete one or more storage areas from the database.

  ```
  $ SQL$
  ```

```
alter database filename mf_personnel
  drop storage area area1
  drop storage area area2
  drop storage area area3
  drop storage area area4;
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
$
```

- Reserve database entries for additional storage areas.

```
$ SQL$
alter database filename mf_personnel
  reserve 10 storage areas;
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
$
```

- Modify the live storage area page allocation.

```
$ SQL$
alter database filename mf_personnel
  alter storage area jobs allocation is 2000 pages;
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
$
```

- Modify the maximum number of database users.

```
$ SQL$
alter database filename mf_personnel
  number of users is 50;
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
$
```

- Modify the maximum number of database cluster nodes.

```
$ SQL$
alter database filename mf_personnel
  number of cluster nodes is 4;
%RDMS-W-FULBCKREQ, The next database backup must be a full backup
```

8.1.2 RMU Extract Now Extracts SYS_GET_DIAGNOSTIC Function

With this release of Oracle Rdb, the RMU Extract command now correctly formats the SYS_GET_DIAGNOSTIC function, which was added in earlier releases.

Chapter 9
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.4

9.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.4

9.1.1 New RMU/SHOW/STATISTICS Output File Periodic Buffer Flushes

When a system failure occurred, important diagnostic data could be lost from the Oracle Rdb RMU/SHOW STATISTICS output files: the binary file used to record Oracle Rdb database statistics for later replay; the logical area access log file; the record access dbkey log file; the process deadlock log file; the lock timeout log file; the OPCOM messages log file; the Hot Standby log file; the online analysis log file; and the stall messages log file. To minimize the loss of diagnostic data from these RMU/SHOW STATISTICS output files, periodic buffer data flushes will now occur if these files are created. These periodic output file data flushes will be the default. The user will be able to modify the periodic flush interval or specify that periodic buffer flushes are not to occur.

The syntax for this new RMU/SHOW STATISTICS qualifier is as follows.

```
/FLUSH_INTERVAL=seconds
/NOFLUSH_INTERVAL
```

The default if the new /FLUSH_INTERVAL qualifier is not specified will be a periodic flush interval of 60 seconds. The minimum flush interval that can be specified is 0 seconds. The maximum flush interval that can be specified is 3600 seconds (1 hour). Specifying 0 seconds for the flush interval is equivalent to specifying /NOFLUSH_INTERVAL. If the flush interval is active and less than the statistics collection interval, to avoid unnecessary buffer flushes the flush interval will be set to the statistics collection interval, which has a default of 3 seconds and can be set by the existing /TIME qualifier, or by typing an "S" if "Set rate" is displayed at the bottom of the statistics screen. The currrent collection interval is displayed following "Rate:" in the statistics screen header.

The first and second command examples below use the default flush interval of 60 seconds. The third and fourth command examples below specify a flush interval of 10 seconds. Note that the flush interval can be set even if the RMU/SHOW STATISTICS command does not specify any log or output files. This is because the TOOLS menu can be used later in the RMU/SHOW STATISTICS session to create log files for which the flush interval of 60 or 10 will be used.

```
$ RMU/SHOW STATISTICS MF_PERSONNEL
$ RMU/SHOW STATISTICS/OUTPUT=SHOWSTAT.DAT/DBKEY_LOG=D.LOG MF_PERSONNEL
$ RMU/SHOW STATISTICS/FLUSH_INTERVAL=10 MF_PERSONNEL
$ RMU/SHOW STATISTICS/FLUSH_INTERVAL=10/OUTPUT=SHOWSTAT.DAT/DBKEY_LOG=D.LOG
MF_PERSONNEL
```

The following command example specifies a statistics collection interval of 12 seconds using the /TIME command qualifier. This is larger than the 10 seconds specified by the new /FLUSH_INTERVAL qualifier. Since the collection interval is larger than the flush interval, the collection interval will be used for the flush interval to avoid excess buffer flushes.

```
$ RMU/SHOW STATISTICS/FLUSH_INTERVAL=10/TIME=12/OUTPUT=SHOWSTAT.DAT
/DBKEY_LOG=D.LOG MF_PERSONNEL
```

The following command examples are equivalent and specify that periodic buffer flushes will not be used for the RMU/SHOW STATISTICS binary output and log files.

```
$ RMU/SHOW STATISTICS/NOFLUSH_INTERVAL/OUTPUT=SHOWSTAT.DAT/DBKEY_LOG=D.LOG
MF_PERSONNEL
$ RMU/SHOW STATISTICS/FLUSH_INTERVAL=0/OUTPUT=SHOWSTAT.DAT/DBKEY_LOG=D.LOG
MF_PERSONNEL
```

This enhancement has been added to Oracle Rdb Release 7.2.5.4.

Chapter 10
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.3

10.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.3

10.1.1 SQL Now Supports SQL Standard Syntax for SET CONSTRAINTS ALL

This release of Oracle Rdb now supports the ANSI/ISO SQL Standard statement SET CONSTRAINTS in addition to the older Rdb syntax.

```
SET -+-> ALL CONSTRAINTS -+----+--+-> DEFERRED ---+-->
     |                    |  |  |                  |
     +-> CONSTRAINT --+-> ALL -+  +-> IMMEDIATE --+
     |                |           |                 |
     +-> CONSTRAINTS -+           +-> DEFAULT ----+
                                  |                 |
                                  +-> ON ----------+
                                  |                 |
                                  +-> OFF ---------+
```

The existing SET ALL CONSTRAINTS statement is retained for backward compatibility.

This problem has been corrected in Oracle Rdb Release 7.2.5.3.

10.1.2 New RMU/DUMP/BACKUP Enhanced Error Handling Features

When the RMU/DUMP/BACKUP command detected a non−fatal error as it was reading an Oracle Rdb database backup file, it reported the error but continued with the dump to determine if there were other errors in the backup file. In addition, RMU/DUMP/BACKUP returned a success status in the $STATUS symbol when it finished reading the backup file and had a normal termination, whether or not it had output errors it detected while reading the backup file.

If the RMU/DUMP/BACKUP command is being used just to verify the validity of the backup file, reading the entire backup file just to determine if it is valid can take a long time for large backup files, especially if they are on tape media. In addition, the success status in the $STATUS symbol when the dump completed sometimes caused errors output during the dump to be missed or unnecessary time to be spent searching for any errors in an RMU/DUMP/BACKUP batch job log file.

To fix these problems, the RMU/DUMP/BACKUP error handling has been enhanced. The last most serious error detected by RMU/DUMP/BACKUP during the dump of the backup file will now always be put in the symbol $STATUS which can be tested when RMU/DUMP/BACKUP completes or aborts by executing the VMS command "SHOW SYMBOL $STATUS". In addition, a new [NO]EXIT_ERROR qualifier has been added to the RMU/DUMP/BACKUP command to optionally abort the dump operation as soon as an error is detected reading the backup file.

```
[NO]EXIT_ERROR
```

NOEXIT_ERROR, the default, keeps the current functionality: the RMU/DUMP/BACKUP operation will only be aborted if a fatal error is detected which prevents RMU/DUMP/BACKUP from continuing to dump the database backup file.

In the following example, the /EXIT_ERROR qualifier is specified with the RMU/DUMP/BACKUP command. When the first error is detected while reading the backup file, MF_PERSONNEL.RBF, the dump operation is aborted and the status of the error which caused the dump to be aborted, RMU−E−BLOCKLOST, is saved in the $STATUS symbol when the RMU/DUMP/BACKUP command exits.

```
$ RMU/DUMP/BACKUP/EXIT_ERROR MF_PERSONNEL.RBF
%RMU-I-DMPTXT_163, No dump option selected. Performing read check.
%RMU-E-BLOCKLOST, block of DEVICE:[DIRECTORY]MF_PERSONNEL.RBF; lost due to
unrecoverable error
%RMU-F-FATALERR, fatal error on DUMP_BACKUP
%RMU-F-FTL_DUMP, Fatal error for DUMP operation at  1-MAY-2013 11:32:13.45
$ SHOW SYMBOL $STATUS
  $STATUS == "%X12C8821A"
```

In the following example, the /NOEXIT_ERROR qualifier is first specified with the RMU/DUMP/BACKUP command. This is the default so the second RMU/DUMP/BACKUP command, which does not specify the /NOEXIT_ERROR qualifier, has the same results as the first RMU/DUMP/BACKUP command which does specify the /NOEXIT_ERROR qualifier. When non−fatal errors are detected reading the backup file, MF_PERSONNEL.RBF, the dump operation continues and is not aborted. But now the status of the last most severe error detected reading the backup file, RMU−E−BLOCKLOST, is saved in the $STATUS symbol when the RMU/DUMP/BACKUP command finishes reading the backup file, not a success status. A count is also given of any soft media errors which were not reported because they did not reoccur when retrying the media read operations.

```
$ RMU/DUMP/BACKUP/NOEXIT_ERROR MF_PERSONNEL.RBF
%RMU-I-DMPTXT_163, No dump option selected. Performing read check.
%RMU-E-BLOCKLOST, block of DEVICE:[DIRECTORY]MF_PERSONNEL.RBF; lost due to
unrecoverable error
%RMU-I-SOFTRERRS, 5 recoverable media errors occurred reading
DEVICE:[DIRECTORY]MF_PERSONNEL.RBF;
$ SHOW SYMBOL $STATUS
  $STATUS == "%X12C8821A"
$ RMU/DUMP/BACKUP MF_PERSONNEL.RBF
%RMU-I-DMPTXT_163, No dump option selected. Performing read check.
%RMU-E-BLOCKLOST, block of DEVICE:[DIRECTORY]MF_PERSONNEL.RBF; lost due to
unrecoverable error
%RMU-I-SOFTRERRS, 5 recoverable media errors occurred reading
DEVICE:[DIRECTORY]MF_PERSONNEL.RBF;
$ SHOW SYMBOL $STATUS
  $STATUS == "%X12C8821A"
```

10.1.3 RMU/DUMP/BACKUP Now Dumps Plan File Parameters for Parallel Backups

For non−parallel Oracle Rdb database backups, the RMU/BACKUP command from the command line is saved in the backup file summary record as one continuous line. The RMU/DUMP/BACKUP command will print out the backup command from the summary record following the characters "COMMAND =".

For parallel Oracle Rdb database backups, implemented using the RMU/BACKUP/PARALLEL and RMU/BACKUP/PLAN commands, a plan file is created or read which contains the backup parameters that are actually executed. Therefore, the backup plan name from the backup plan file was saved in the backup file summary record instead of the command line parameters. However, if the plan file was no longer available or the plan file was just a temporary file created by the backup and then deleted, the plan file parameters used to create the backup file would be lost and could not be determined by using the RMU/DUMP/BACKUP command.

To solve this problem, the actual parallel backup parameters from the backup plan file executed by RMU/BACKUP/PARALLEL or RMU/BACKUP/PLAN will now be saved in the backup file summary record as one continuous line instead of just the plan file name. The RMU/DUMP/BACKUP command will now print out the parallel backup plan parameters stored in the backup file summary record following the characters "COMMAND =". Note that a direct copy of the plan file will not be saved in the summary record, but all the plan file parameters which are equivalent to command line parameters will be saved. Plan file comments and plan file parameters equivalent to command line parameters which are documented as default parameters, which do not have to be specified for the parallel backup, will not be saved.

The following example demonstrates this new feature. The parallel backup command creates and executes a plan file based on the command line parameters. In this case, the plan file created is saved in a file called MFP.PLAN specified using the /LIST_FILE qualifier, but if the /LIST_FILE qualifier is not specified, the plan file parameters will not be saved in a created plan file. However, because of this new feature, the plan file parameters are always saved in the summary record and can then be dumped using the RMU/DUMP/BACKUP command. A search for "COMMAND =" will find the continuous line containing the plan file parameters used to create the backup file. Note that most of the data output by the dump is not shown in the example below. The plan file parameters displayed following "COMMAND =" will be one continuous line with parameters separated by five or more spaces equivalent to the indent used for the parameter in the plan file. Carriage returns have been inserted in the example below just to make all the command line parameters easily visible for this example.

```
$ RMU/BACKUP/ENCRYPT=(VALUE="my test key")/PARALLEL=(EXECUTOR_COUNT=2) -
        /EXTEND=64000/DISK_FILE=(WRITER_THREADS=2) -
        /PAGE_BUFFERS=5/ONLINE/QUIET_POINT -
        /LIST_PLAN=MFP.PLAN/NOLOG -
        MF_PERSONNEL.RDB -
        DISK:[DIRECTORY]MFP.RBF, -
        DISK:[DIRECTORY]
%RMU-I-ENCRYPTUSED, Encryption key required when future restore performed.
$ RMU/DUMP/BACKUP/ENCRYPT=(VALUE="my test key") -
        /DISK_FILE/OPTION=DEBUG -
        DISK:[DIRECTORY]MFP.RBF, -
        DISK:[DIRECTORY]

*-----------------------------------------------------------------------------
* Oracle Rdb X7.2-00                                    10-MAY-2013 10:06:29.55
*
* Dump of Database Backup Header
*     Backup filename: MFP.RBF
*     Backup file database version: 7.2
*
*-----------------------------------------------------------------------------

BACKUP FILE = MFP.RBF

COMMAND =     Plan Name = MFP    Plan Type = BACKUP
    Database Root File = DISK:[DIRECTORY]PERSONNEL.RDB;1
    Backup File = MFP.RBF    Style = Multifile    PromptAutomatic
```

```
    Tape_Expiration = 10-MAY-2013    Active_IO = 3    Threads = 0
    Page_Buffers = 5    Extend_Quantity = 64000    Nolog    Statistics    ACL
    Encrypt = (Value="my test key",Algorithm="DESCBC")    CRC = AUTODIN_II
    Online    Quiet_Point
    Executor Parameters :    Writer_threads = 1
    Directory List        DISK:[DIRECTORY.G1]
    End Directory List    End Executor Parameters
    Executor Parameters :    Writer_threads = 1
    Directory List        DISK:[DIRECTORY.G2]
    End Directory List    End Executor Parameters

ROOT_FILE = DISK:[DIRECTORY]MF_PERSONNEL.RDB;1

DRIVE = _DISK

$
```

Chapter 11
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.2

11.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.2

11.1.1 New Prefix Added to Logical Name Created by the Log Recovery Server

In Oracle Rdb and Oracle CODASYL DBMS, the Log Recovery Server (LRS) used for database replication creates a system logical name when database replication is started. This logical name is a changing encoded numeric hexadecimal device name which points to the current LRS server VMS hexadecimal process id (PID). This logical name is used for communication between the LRS, AIJ, LCS and ALS servers. Unlike other logicals created by Rdb and DBMS, this logical name gave no indication that it was created by the Rdb or DBMS LRS server.

The following is an example of this logical name in previous versions of Rdb and DBMS.

```
$ SHOW LOGICAL/SYSTEM 31414744*

(LNM$SYSTEM_TABLE)

  "314147442431245F0A000001B90318" = "224DDC17"
```

Now a prefix has been added to this logical name to identify it as being created by the Rdb or DBMS LRS server when database replication is started. The new prefix for this logical name is "RDM$LRS" for Rdb.

```
$ SHOW LOGICAL/SYSTEM RDM$LRS*

(LNM$SYSTEM_TABLE)

  "RDM$LRS314147442431245F0A000001B90318" = "224DDC17"
```

The new prefix for this logical name is "DBM$LRS" for DBMS.

```
$ SHOW LOGICAL/SYSTEM DBM$LRS*

(LNM$SYSTEM_TABLE)

  "DBM$LRS314147442431245F0A000001B90318" = "224DDC17"
```

This system logical is deleted if the LRS server terminates normally or is terminated by a detected error condition. However, it is possible in some cases of abnormal and unexpected LRS process failure that this logical does not get deleted by the LRS process. This new prefix will make it easier to identify this system logical and to delete it if the LRS process terminates abnormally without deleting this system logical.

The following example shows references to this logical in the logs of the LRS and AIJ database replication servers. In these logs, this logical is referred to as the "tincan" logical because it is used as a tool for basic communication between the database replication servers.

```
$ RMU/REPLICATE AFTER_JOURNAL START SQL$DATABASE  /LOG /WAIT -
   /CONNECT_TIMEOUT=30
$ TYPE LRS_S_21B994CF.LOG
```

```
 2-MAR-2012 10:02:16.59 - Server name: "324147442431245F0A0000004639CE"
 2-MAR-2012 10:02:16.59 - Creating tincan owner "324147442431245F0A0000004639CE"
 2-MAR-2012 10:02:16.59 - Creating tincan logical name
"RDM$LRS324147442431245F0A0000004639CE"

$ TYPE AIJSRV_S_21A0C0D1.LOG

 2-MAR-2012 10:02:18.47 - Retrieving tincan owner
"324147442431245F0A0000004639CE"
 2-MAR-2012 10:02:18.47 - Retrieving tincan logical name
"RDM$LRS324147442431245F0A0000004639CE"

$ RMU/REPLICATE AFTER_JOURNAL STOP SQL$DATABASE

$ TYPE LRS_S_21B994CF.LOG
 2-MAR-2012 10:10:34.22 - Deleting tincan owner "324147442431245F0A0000004639CE"
 2-MAR-2012 10:10:34.22 - Deleting tincan logical name
"RDM$LRS324147442431245F0A0000004639CE"
```

The following example shows how this logical can be deleted if for any reason database replication has been terminated abnormally and this logical has not been deleted by the LRS server. This logical should never be deleted while database replication is active or replication errors can occur. It should only be deleted if for any reason the LRS replication server fails to delete this logical before it terminates.

```
$ SHOW LOGICAL/SYSTEM RDM$LRS*

(LNM$SYSTEM_TABLE)

  "RDM$LRS314147442431245F0A000001B90318" = "224DDC17"

$ DEASSIGN/SYSTEM RDM$LRS314147442431245F0A000001B90318

$ SHOW LOGICAL/SYSTEM DBM$LRS*

(LNM$SYSTEM_TABLE)

  "DBM$LRS314147442431245F0A000001B90318" = "224DDC17"

$ DEASSIGN/SYSTEM DBM$LRS314147442431245F0A000001B90318
```

11.1.2 Information Tables Updated

The following additions have been made to the RDB$CACHES information table.

- RDB$SWEEP_FREE_PCT − Percent of slots to free during sweep.
- RDB$SWEEP_BATCH_COUNT − Number of records to batch write.
- RDB$FLAGS
- Bit 8 − Use memory−resident section for cache.

The following additions have been made to the RDB$DATABASE_ROOT information table.

- RDB$UNIQUE_VERSION − Physical database create time−and−date. This field contains the time−and−date stamp when this physical database was created / restored / copied.
- RDB$FLAGS
- Bit 30 − Security audit enabled.

- Bit 31 − Security alarm enabled flag.
- Bit 32 − Audit/alarm on first access only.
- Bit 33 − Audit synchronous flush flag.
- Bit 34 − Standby database is opened read−only.
- Bit 35 − Roll−forward quiet−point enabled.
- Bit 36 − Database has been modified while LSS inactive.
- Bit 37 − Continuous LogMiner feature enabled.
- Bit 38 − AIJ buffer objects enabled.
- Bit 39 − OBJMAN buffer objects enabled.
- Bit 40 − Page buffer objects enabled.
- Bit 41 − RUJ buffer objects enabled.

The following addition has been made to the RDB$DATABASE_JOURNAL information table.

- RDB$LSS_NETTYPE − Network transport (DECnet, TCP/IP).

Please refer to the SQL Reference Manual for full details.

11.1.3 RMU/RESTORE/ONLY_ROOT Now Supports the /ENCRYPT Qualifier

The RMU/RESTORE/ONLY_ROOT command restores only the root file (*.RDB) from a backup file (*.RBF) of an Oracle Rdb database. There was a problem which caused the RMU/RESTORE/ONLY_ROOT command to not support the /ENCRYPT qualifier which must be used to restore database files from encrypted Rdb backup files. The only workaround was to do a full restore of all of the Rdb database files including the root file, since the /ENCRYPT command is supported for a full restore of the database.

This problem has been fixed and now the /ENCRYPT qualifier can be used with the RMU/RESTORE/ONLY_ROOT command to restore only the database root file from an encrypted database backup file (*.RBF) created by using the /ENCRYPT qualifier with the RMU/BACKUP command.

The following example shows the problem. The RMU/BACKUP command backs up the MF_PERSONNEL database to the encrypted backup file MF_PERSONNEL_BCK.RBF using the /ENCRYPT qualifier. Then the MF_PERSONNEL database is deleted and then restored from the encrypted MF_PERSONNEL_BCK.RBF using the /ENCRYPT command to de−encrypt the restored database files. Then the restored MF_PERSONNEL.RDB database root file is deleted. When the first RMU/RESTORE/ONLY_ROOT command is used to restore the deleted database root file, an error is output because the /ENCRYPT qualifier must be used to de−encrypt the encrypted backup file. But when the /ENCRYPT qualifier was then specified with the second RMU/RESTORE/ONLY_ROOT command, the root file restore failed because the RMU/RESTORE/ONLY_ROOT command did not support the /ENCRYPT qualifier.

```
$ RMU/BACKUP/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG −
 MF_PERSONNEL.RDB MF_PERSONNEL_BCK.RBF
%RMU−I−ENCRYPTUSED, Encryption key required when future restore performed.
$ SQL
DROP DATABASE FILENAME MF_PERSONNEL;
EXIT;
$ RMU/RESTORE/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOCDD/NOLOG
MF_PERSONNEL_BCK
%RMU−I−AIJRSTAVL, 0 after−image journals available for use
%RMU−I−AIJISOFF, after−image journaling has been disabled
%RMU−W−USERECCOM, Use the RMU Recover command. The journals are not available.
```

```
$ RMU/VERIFY/NOLOG MF_PERSONNEL
$ DELETE MF_PERSONNEL.RDB;*
$ RMU/RESTORE/ONLY_ROOT/NOLOG MF_PERSONNEL_BCK
%RMU-F-ENCRYPTSAVSET, save set is encrypted, /ENCRYPT must be specified
%RMU-F-FATALERR, fatal error on RESTORE_ROOT_ONLY
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 21-JUN-2012 09:31:56.41
$ RMU/RESTORE/ONLY_ROOT/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG
MF_PERSONNEL_BCK.RBF
%DCL-W-IVQUAL, unrecognized qualifier - check validity, spelling, and placement
\ENCRYPT\
```

The following example shows that this problem has been fixed and that /ENCRYPT is not supported. The RMU/BACKUP command backs up the MF_PERSONNEL database to the encrypted backup file MF_PERSONNEL_BCK.RBF using the /ENCRYPT qualifier. Then the MF_PERSONNEL database is deleted and then restored from the encrypted MF_PERSONNEL_BCK.RBF using the /ENCRYPT command to de-encrypt the restored database files. Then the MF_PERSONNEL.RDB database root file is deleted. When the first RMU/RESTORE/ONLY_ROOT command is used to restore the deleted database root file, an error is output because the /ENCRYPT qualifier must be used to de-encrypt the encrypted backup file. Now when the /ENCRYPT qualifier is then specified with the second RMU/RESTORE/ONLY_ROOT command, the root file restore succeeds because the RMU/RESTORE/ONLY_ROOT command now supports the /ENCRYPT qualifier.

```
$ RMU/BACKUP/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG -
 MF_PERSONNEL.RDB MF_PERSONNEL_BCK.RBF
%RMU-I-ENCRYPTUSED, Encryption key required when future restore performed.
$ SQL
DROP DATABASE FILENAME MF_PERSONNEL;
EXIT;
$ RMU/RESTORE/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOCDD/NOLOG
MF_PERSONNEL_BCK
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
%RMU-W-USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/VERIFY/NOLOG MF_PERSONNEL
$ DELETE MF_PERSONNEL.RDB;*
$ RMU/RESTORE/ONLY_ROOT/NOLOG MF_PERSONNEL_BCK
%RMU-F-ENCRYPTSAVSET, save set is encrypted, /ENCRYPT must be specified
%RMU-F-FATALERR, fatal error on RESTORE_ROOT_ONLY
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 21-JUN-2012 09:45:52.41
$ RMU/RESTORE/ONLY_ROOT/ENCRYPT=(VALUE="My secret key",ALGORITHM=DESCBC)/NOLOG
MF_PERSONNEL_BCK.RBF
%RMU-I-AIJRSTAVL, 0 after-image journals available for use
%RMU-I-AIJISOFF, after-image journaling has been disabled
$ RMU/VERIFY/NOLOG MF_PERSONNEL
```

This new feature is supported in Oracle Rdb Release 7.2.5.2.

11.1.4 New Option POSITION_COLUMN Added to RMU Extract

Bug 14085671

In prior versions of Oracle Rdb, tables that were altered to reorder columns using BEFORE COLUMN and AFTER COLUMN clauses were extracted as a CREATE TABLE statement followed by an ALTER TABLE statement. This is done by RMU Extract to ensure that dependencies between columns (COMPUTED BY,

AUTOMATIC AS and DEFAULT clauses) are maintained, if possible.

The following example shows the output for a simple table.

```
create table TEST_TABLE (
    FLD1
        CHAR (10),
    FLD2
        CHAR (10),
    FLD3
        CHAR (10));

    -- apply the alternate column ordering
    alter table TEST_TABLE
        alter column FLD3 before column FLD1;
```

In some cases, the user may wish only a CREATE TABLE statement. Therefore, this release of RMU Extract supports a new Option, POSITION_COLUMN, which will order columns by position instead of the default field identification. Note that such definitions may not be able to create the table if referenced columns appear after their reference. The default option is NOPOSITION_COLUMN.

Chapter 12
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.1

12.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.1

12.1.1 New RMU Options File to Modify the Row Cache Backing Store Directories

The Oracle Rdb RMU "/SET ROW CACHE" command currently allows the Row Cache per−database default backing store directory and the database per−cache backing store directories to be specified or removed in the database root file. If the specified per−cache backing store directory is removed, the per−database backing store directory will be used and if the specified per−database backing store directory is removed, the root file device and directory will be the default backing store location. When the RMU/RESTORE, RMU/COPY_DATABASE and RMU/MOVE_AREA commands are used to change the location of the database root file, it would be convenient to be able to also modify the per−database and/or per−cache Row Cache backing store directories at the same time. This new feature allows an options file to be specified with the RMU/RESTORE, RMU/COPY_DATABASE and RMU/MOVE_AREA commands to modify and/or remove the per−database and/or per−cache Row Cache backing store directory specifications.

The following new optional qualifier can be specified with the RMU/RESTORE, RMU/COPY_DATABASE and RMU/MOVE_AREA commands to specify a Row Cache backing store options file which contains per−database and/or per−cache Row Cache backing store directory specifications.

```
/ROW_CACHE_OPTIONS = file_specification
```

The "file_specification" must be a valid file specification of an existing options file. This qualifier cannot be negated. The following syntax must be used in the row cache backing store options file.

```
$ type filename.opt
/BACKING_STORE = device:[directory]
row_cache_name /BACKING_STORE = device:[directory]
row_cache_name /NOBACKING_STORE
```

To modify or remove the current per−database default backing store location, either "/BACKING_STORE =" followed by a valid directory specification or "/NOBACKING_STORE" must be specified on the first line without being preceded by a Row Cache name. To modify or remove a current per−cache backing store location, an existing Row Cache name currently defined in the database root file must be specified followed by either "/BACKING_STORE =" followed by a valid directory specification or "/NOBACKING_STORE" must be specified. The wild card characters "%" and/or "*" can be specified as part of the Row Cache name, where "*" can be used in the place of one or more contiguous characters and "%" can be used in the place of a single character. In this case all matching per−cache backing store entries will be modified with the following "/BACKING_STORE =" or "/NOBACKING_STORE" specification. The RMU/DUMP/HEADER command can be used to display the current per−database default Row Cache backing store directory as well as the current per−cache Row Cache backing store directories.

For the RMU/RESTORE command, the /ROW_CACHE_OPTIONS qualifier cannot be used with the /AREA, /INCREMENTAL, /JUST_CORRUPT, /DUPLICATE or /ONLINE qualifiers. It can be used for a full or /ONLY_ROOT restore. For the RMU/MOVE_AREA command, the /ROW_CACHE_OPTIONS qualifier cannot be used with the /ONLINE or /QUIET_POINT qualifiers. It can only be used if the /ROOT qualifier is specified. For the RMU/COPY_DATABASE command, the /ROW_CACHE_OPTIONS qualifier

cannot be used with the /ONLINE, /QUIET_POINT or /DUPLICATE qualifiers.

The following example shows the RMU/RESTORE, RMU/MOVE_AREA, and RMU/COPY_DATABASE commands used with the /ROW_CACHE_OPTIONS qualifier to read backing store directory options files to modify or remove the current per−database and per−cache Row Cache backing store directories in the database root file. The contents of the options file read is displayed when the command is executed and the RMU/DUMP/HEADER command is used to check the modified backing store directories in the database root file.

```
$ SET VERIFY
$ RMU/RESTORE/NOCDD/NOLOG/DIR=TEST$DIRECTORY−
 /ROW_CACHE_OPTIONS=TEST$DIRECTORY:BSTORE.OPT −
 TEST$DIRECTORY:RSA.RBF
%RMU−I−RESTXT_18, Processing options file BSTORE.OPT
  /BACKING_STORE=DISK:[DIRECTORY]
  SAL_CACHE /BACKING_STORE=DISK:[DIRECTORY]
  JOB_CACHE/BACKING_STORE=DISK:[DIRECTORY]
  DROP_CACHE /BACKING_STORE=DISK:[DIRECTORY]

$ RMU/DUMP/HEADER/OUT=HDR.LIS TEST$DIRECTORY:RMU_SET_RCACHE_ALTER_DB
$ SEARCH HDR.LIS "DEFAULT BACKING FILE DIRECTORY"
          Default backing file directory is "DISK:[DIRECTORY]"
$ SEARCH HDR.LIS "CACHE FILE DIRECTORY"
      − Cache file directory is "DISK:[DIRECTORY]"
      − Cache file directory is "DISK:[DIRECTORY]"
      − Cache file directory is "DISK:[DIRECTORY]"
$ RMU/MOVE_AREA/NOLOG/DIRECTORY=DISK:[DIRECTORY]−
 /ROOT=DISK:[DIRECTORY]FILENAME.EXT
 /ROW_CACHE_OPTIONS=TEST$DIRECTORY:WBSTORE.OPT −
 TEST$DIRECTORY:RMU_SET_RCACHE_ALTER_DB
%RMU−I−RESTXT_18, Processing options file WBSTORE.OPT
  *CACHE /BACKING_STORE=DISK:[DIRECTORY]

$ RMU/DUMP/HEADER/OUT=HDR.LIS DISK:[DIRECTORY]FILENAME.EXT
$ SEARCH HDR.LIS "DEFAULT BACKING FILE DIRECTORY"
          Default backing file directory is "DISK:[DIRECTORY]"
$ SEARCH HDR.LIS "CACHE FILE DIRECTORY"
      − Cache file directory is "DISK:[DIRECTORY]"
      − Cache file directory is "DISK:[DIRECTORY]"
      − Cache file directory is "DISK:[DIRECTORY]"
$ RMU/COPY_DATABASE/NOLOG/DIRECTORY=DISK:[DIRECTORY]−
 /ROW_CACHE_OPTIONS=TEST$DIRECTORY:NOBSTORE.OPT −
 TEST$DIRECTORY:RMU_SET_RCACHE_ALTER_DB
%RMU−I−RESTXT_18, Processing options file NOBSTORE.OPT
  /NOBACKING_STORE
  SAL_CACHE /NOBACKING_STORE
  JOB_CACHE/NOBACKING_STORE
  DROP_CACHE /NOBACKING_STORE

$ RMU/DUMP/HEADER/OUT=HDR.LIS DISK:[DIRECTORY]FILENAME.EXT
$ SEARCH HDR.LIS "DEFAULT BACKING FILE DIRECTORY"
          Default backing file directory is database directory
$ SEARCH HDR.LIS "CACHE FILE DIRECTORY"
      − Derived cache file directory is "DISK:[DIRECTORY]"
      − Derived cache file directory is "DISK:[DIRECTORY]"
      − Derived cache file directory is "DISK:[DIRECTORY]"
```

12.1.2 New RMU/REPAIR Options File to Initialize Database Snapshot Files

The Oracle Rdb RMU "RMU/REPAIR/INITIALIZE=SNAPSHOTS" command currently allows the user to create and/or initialize new snapshot files when a snapshot file is deleted or corrupted. The "RMU/REPAIR/INITIALIZE=SNAPSHOTS=CONFIRM" command prompts the user not only to initialize snapshot files but also to optionally rename, move, or change the allocation of snapshot files. The "/AREAS" qualifier can also be specified to only initialize the snapshot files associated with the specified list of storage area names. This new feature allows the use of an options file with RMU/REPAIR to initialize snapshot files. This allows the user to avoid prompts for each snapshot file to be initialized and makes it more convenient to initialize a large number of options files in one RMU/REPAIR command.

The following optional new syntax can be specified with the RMU/REPAIR command to use an options file to initialize snapshot files.

```
/INITIALIZE=SNAPSHOTS=OPTIONS=file_specification
```

The "file_specification" must be the valid file specification of an existing options file. This qualifier cannot be negated. The following syntax must be used in the specified options file.

```
$ type filename.opt
storage_area [/SNAPSHOT=([FILE=file_specification][,][ALLOCATION=n])]
```

In the above, "storage_area" specifies the name of the storage area which uses the snapshot file. The "RMU/DUMP/HEADER" command can be used to display the storage area names contained in the database root file − see 'Snapshot area for storage area "storage_area"'. "FILE=file_specification" specifies an optional new file specification for the snapshot file. The "RMU/DUMP/HEADER" command can be used to display the snapshot file specifications contained in the database root file − see 'Filename is "device:[directory]name.SNP;1"'. The snapshot file specification cannot be changed for a single file database. "ALLOCATION=n" specifies an optional new page count allocation size for the snapshot file. By specifying a new allocation for a snapshot file, you can truncate a snapshot file or make it larger. The "RMU/DUMP/HEADER" command can be used to display the allocation size for the snapshot file − see "Current physical page count is n". Note that if the "/AREAS" qualifier is used in the same RMU/REPAIR command with "/INITIALIZE=SNAPSHOTS=OPTIONS=file_specification" it will be in effect for other RMU/REPAIR options but will be ignored for the "/INITIALIZE=SNAPSHOTS" option since the options file specifies the storage areas that use the snapshot files to be initialized.

In the following example, "SET VERIFY" is specified to display the contents of the JUST_AREA.OPT options file which specifies that the snapshot files for the departments, jobs and salary_history storage areas in the MF_PERSONNEL database are to be initialized. Since the JOBS.SNP snapshot file has been deleted, it will be created before it is initialized. The current snapshot file specifications and allocations are used. An RMU/VERIFY of MF_PERSONNEL is done after the repair to verify the integrity of the database.

```
$ set verify
$ del jobs.snp;*
$ dir jobs.snp
%DIRECT-W-NOFILES, no files found
$!
$ RMU/REPAIR/INIT=SNAPSHOTS=OPTIONS=JUST_AREA.OPT MF_PERSONNEL
%RMU-I-FULBACREQ, A full backup of this database should be
 performed after RMU REPAIR
  departments
```

```
  jobs
  salary_history
$!
$ dir jobs.snp

Directory DEVICE:[DIRECTORY]

JOBS.SNP;1

Total of 1 file.

$ RMU/VERIFY/ALL/NOLOG MF_PERSONNEL
$
```

In the following example, "SET VERIFY" is specified to display the contents of the AREA_SNAP.OPT options file which specifies that the snapshot files for the departments, jobs and salary_history storage areas in the MF_PERSONNEL database are to be initialized with a new file specification and page count allocation. An RMU/VERIFY of MF_PERSONNEL is done after the repair to verify the integrity of the database.

```
$ set verify
$ RMU/REPAIR/INIT=(SNAPSHOTS=OPTIONS=AREA_SNAP.OPT) MF_PERSONNEL
%RMU-I-FULBACREQ, A full backup of this database should be
 performed after RMU REPAIR
  departments /snapshot=(file=new_dept,allocation=200)
  jobs /snapshot=(file=new_jobs,allocation=210)
  salary_history /snapshot=(file=new_sal_hist,allocation=220)
$ RMU/VERIFY/ALL/NOLOG MF_PERSONNEL
$
```

12.1.3 RDMSTT Image Optionally Installed

Bug 3981803

If you plan on using the cluster capability of RMU/SHOW STATISTICS, Oracle recommends that you install the RDMSTT72.EXE image on OpenVMS with the appropriate privileges.

For Oracle Rdb Release 7.2.5.1 and later, the RMONSTART72.COM command procedure has been modified to optionally install the RDMSTT72.EXE image at monitor startup time. To take advantage of this, you will need to edit the RMONSTART72.COM procedure and remove the comment characters from the following lines:

```
$ ! DEFX SYS$COMMON:[SYSEXE]RDMSTT72.EXE
$ !     REMOVEX
$ !     ADDX /OPEN/HEAD/PROT/PRIV=(CMKRNL,SYSPRV,SHARE)
```

Also, edit the RMONSTOP72.COM procedure and remove the comment characters from the following lines:

```
$ ! DEFX SYS$COMMON:[SYSEXE]RDMSTT72.EXE
$ !     REMOVEX
```

This feature has been added to Oracle Rdb Release 7.2.5.1.

12.1.4 RMU Show Statistics Now Includes New Rdb Executive Statistics

This release of Oracle Rdb changes the RMU Show Statistics command in the following ways:

- The Rdb Executive Statistics screen now includes two new items: "request create" and "request release".
  These statistics closely correspond to the dynamic SQL DECLARE CURSOR and RELEASE statements. In general, interactive SQL will create and release a request for each interactive query, unless it is a cursor which will be retained until DISCONNECT. Compiled (SQL$MOD or SQL$PRE) applications will release queries only upon DISCONNECT (unless they are using dynamic SQL).
  The statistic "request create" counts the loading of a query, stored procedure, or stored function. The statistic "request release" counts the release of such requests (which will include release of virtual memory and release of metadata locks). Note that these statistics will also include queries executed by the SQL runtime environment.
- The statistic named "queries compiled" has been renamed as "subquery compiles" to better describe its function. Any configuration file which uses the old name will need to be changed. The new "request create" is a better metric if a count of compiled queries is required.
  This statistic is incremented when each table context is compiled, such as each branch of a UNION, join or nested subquery.

Chapter 13
Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.0

13.1 Enhancements And Changes Provided in Oracle Rdb Release 7.2.5.0

13.1.1 RMU /SHOW STATISTICS /ROWS= and /COLUMNS= Feature

Previously, it was not possible to use the RMU /SHOW STATISTICS and specify the number of display rows and columns. The values would default to the user's display or, in the case of non−interactive mode, 132 columns and 66 rows.

This problem has been corrected in Oracle Rdb Release 7.2.5. RMU /SHOW STATISTICS includes the new qualifiers /ROWS=n and /COLUMNS=n to allow the user to specify the desired number of display rows and columns. The existing minimum and maximum limits apply as enforced by the SMG run time library or the RMU /SHOW STATISTICS utility.

13.1.2 New LIMIT Clauses Implemented for the CREATE and ALTER PROFILE Statement

In prior versions of Oracle Rdb, the LIMIT clauses of the CREATE PROFILE statement and the ALTER PROFILE statement were incomplete. These clauses are now active in this release of Rdb.

The following information replaces the description of these clauses in the current Oracle Rdb SQL Reference Manual, Volume 2 for the CREATE PROFILE Statement.

Arguments

- LIMIT CPU TIME
  LIMIT CPU TIME sets the maximum CPU time that can be used by the query compiler. The keyword DEFAULT indicates that no value is defined by this profile and is equivalent to NO LIMIT CPU TIME.
  If a numeric value or the keyword UNLIMITED is specified then this value will be used even when the SET QUERY LIMIT CPU TIME statement is present in the session, or when the logical name RDMS$BIND_QG_CPU_TIMEOUT is defined.
  NO LIMIT CPU TIME is the default. Units can be specified as seconds or minutes.
- LIMIT TIME
  LIMIT TIME sets the maximum elapsed time that can be used by the query compiler. The keyword DEFAULT indicates that no value is defined by this profile and is equivalent to NO LIMIT TIME.
  If a numeric value or the keyword UNLIMITED is specified then this value will be used even when the SET QUERY LIMIT TIME statement is present in the session, or when the logical name RDMS$BIND_QG_TIMEOUT is defined.
  NO LIMIT TIME is the default. Units can be specified as seconds or minutes.
- LIMIT ROWS
  LIMIT ROWS sets the maximum number of rows that can be returned by a query started by the user. The keyword DEFAULT indicates that no value is defined by this profile and is equivalent to NO LIMIT ROWS.
  If a numeric value or the keyword UNLIMITED is specified then this value will be used even when

the SET QUERY LIMIT ROWS statement is present in the session, or when the logical name RDMS$BIND_QG_REC_LIMIT is defined.
NO LIMIT ROWS is the default.

Examples

This example shows the use of the LIMIT clauses to set boundaries for standard database users.

```
SQL> create profile STANDARD_USER
cont>    limit rows 10000
cont>    limit time 10 minutes
cont>    limit cpu time 20 seconds;
SQL> show profile STANDARD_USER;
     STANDARD_USER
     Limit rows 10000
     Limit time 10 minutes
     Limit CPU time 20 seconds
SQL> alter profile STANDARD_USER
cont>    limit time 60 minutes;
```

Usage Notes

- The logical names RDMS$BIND_QG_REC_LIMIT, RDMS$BIND_QG_TIMEOUT, and RDMS$BIND_QG_CPU_TIMEOUT establish the process defaults for the query limit.
- The command SET QUERY LIMIT establishes the session default (unless already set by the query governor logical names).
- The profile LIMIT will either use these established defaults (LIMIT ... DEFAULT or NO LIMIT) or override them (LIMIT ... UNLIMITED or specified value).

13.1.3 Use of RMS MBC Larger Than 127

This release of Oracle Rdb takes advantage of OpenVMS enhancements permitting values of the RMS Multi Block Count (MBC) parameter to be up to 255 blocks (the prior limit was 127 blocks). With this change, some disk−based file read and write operations performed by Oracle Rdb may require half of the IO resources as compared with prior releases by allowing RMS to do larger IO transfers.

Oracle Rdb now anticipates that OpenVMS patch(es) have been installed that support using an RMS Multi Block Count (MBC) parameter larger than 127 blocks. Oracle Rdb will first attempt to use a larger value and if an RMS$_MBC error is returned from the SYS$CONNECT call, a second attempt is made with a RMS Multi Block Count (MBC) parameter of less than 128.

In order to receive the IO performance improvements available when accessing sequential files when using an RMS Multi Block Count (MBC) parameter larger than 127 blocks, the following patches (or their subsequent replacements) are required to be installed:

- VMS84I_UPDATE−V0400 or later
- VMS84A_UPDATE−V0400 or later
- VMS831H1I_SYS−V1200 or later
- VMS83I_SYS−V1500 or later
- VMS83A_SYS−V1800 or later

Oracle recommends installing OpenVMS patches that permit values of the RMS Multi Block Count (MBC) parameter to be up to 255 blocks for best performance and functionality.

13.1.4 New Optimizations for the LIKE Predicate

Bugs 3516321, 9931047 and 9910624

This release of Oracle Rdb will try to rewrite the LIKE predicate when the LIKE pattern is a string literal. This enhancement allows Rdb to simplify some LIKE expressions resulting in reduced I/O and CPU time required to satisfy these queries.

- When the LIKE pattern is only the "%" character (which matches one or more characters in the source string) then this will be replaced with an OCTET_LENGTH (...) >= 0 condition that does not require any pattern matching. Note that a string of "%" wildcards, such as "%%%%%", behaves in the same way as a single "%" character. Therefore, the same optimization is applied when any number of trailing % wildcards are detected.

```
SQL> select count(*)
cont>  from employees
cont>  where middle_initial like '%';
Tables:
  0 = EMPLOYEES
Aggregate: 0:COUNT (*)
Conjunct: OCTET_LENGTH (0.MIDDLE_INITIAL) >= 0
Get     Retrieval sequentially of relation 0:EMPLOYEES

          64
1 row selected
SQL>
```

- When the LIKE pattern is only a series of "_" characters (one or more) and the pattern length is the same size as the CHAR source expression, or the VARCHAR source expression matches the length of the pattern, then this will be replaced with an OCTET_LENGTH (...) = n condition that does not require any pattern matching.
  The following example shows a LIKE match against a fixed length CHAR column STATUS_NAME.

```
SQL> select status_name
cont>  from work_status
cont>  where status_name like '________';
Tables:
  0 = WORK_STATUS
Conjunct: OCTET_LENGTH (0.STATUS_NAME) = 8
Get     Retrieval sequentially of relation 0:WORK_STATUS
 STATUS_NAME
 INACTIVE
 ACTIVE
 ACTIVE
3 rows selected
SQL>
```

  The following example shows the string matching the variable length VARCHAR value which is six octets in length.

```
SQL> -- Find six character LAST_NAME values
SQL> select first_name, middle_initial, last_name
```

```
cont>  from candidates
cont>  where last_name like '______';
Tables:
  0 = CANDIDATES
Conjunct: OCTET_LENGTH (0.LAST_NAME) = 6
Get     Retrieval sequentially of relation 0:CANDIDATES
 FIRST_NAME   MIDDLE_INITIAL   LAST_NAME
 Oscar        M.               Wilson
1 row selected
SQL>
```

- When the LIKE pattern starts with a string not containing wildcard characters ("%", "_", or program supplied escape character) but followed by only the "%" wildcard, then Oracle Rdb can replace this with the STARTING WITH operator.

```
SQL> select employee_id, first_name, last_name
cont>  from employees
cont>  where last_name like 'Smith%';
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: 0.LAST_NAME STARTING WITH 'Smith'
  BgrNdx1 EMPLOYEES_LAST_NAME [1:1] Fan=14
    Keys: 0.LAST_NAME STARTING WITH 'Smith'
 EMPLOYEE_ID   FIRST_NAME   LAST_NAME
 00165         Terry        Smith
 00209         Roger        Smith
2 rows selected
SQL>
```

Note

Oracle Rdb has for some time made use of pattern prefix strings to start index scans when possible. This feature is now highlighted in the STRATEGY output by displaying "(Starting With)" after the LIKE predicate for the index keys. This optimization is applied to string literals, column references, host variables, and other string expressions.

```
SQL> declare :patt varchar(10) = 'Smit%';
SQL> select employee_id, first_name, last_name
cont>  from employees
cont>  where last_name like :patt;
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: 0.LAST_NAME LIKE <var0>
  BgrNdx1 EMPL_LAST_NAME [1:1] Fan=12
    Keys: 0.LAST_NAME LIKE <var0> (Starting With)
    Bool: 0.LAST_NAME LIKE <var0>
 EMPLOYEE_ID   FIRST_NAME   LAST_NAME
 00165         Terry        Smith
 00209         Roger        Smith
2 rows selected
SQL>
```

Conversely, if the LIKE pattern string literal has leading wildcards, then this optimization will be disabled since we know during query compile that such an optimization would provide no benefit and thus we save CPU time for such queries.

```
SQL> select employee_id, first_name, last_name
cont>  from employees
cont>  where last_name like '%Smith%';
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: 0.LAST_NAME LIKE '%Smith%'
  BgrNdx1 EMPL_LAST_NAME [0:0] Fan=12
    Keys: 0.LAST_NAME LIKE '%Smith%'
    Bool: 0.LAST_NAME LIKE '%Smith%'
 EMPLOYEE_ID   FIRST_NAME   LAST_NAME
 00165         Terry        Smith
 00209         Roger        Smith
2 rows selected
SQL>
```

- When the LIKE pattern does not contain any wildcard characters, then the LIKE may be converted to an equals condition with a restriction on the length. In general, this produces better query strategies as it allows leading index segments to be matched, where in prior versions this LIKE reference would terminate the partial key construction.

```
SQL> select count (*)
cont>  from employees
cont>  where sex like 'F';
Tables:
  0 = EMPLOYEES
Aggregate: 0:COUNT (*)
Conjunct: 0.SEX = 'F'
Get     Retrieval by index of relation 0:EMPLOYEES
  Index name  EMPLOYEES_LAST_NAME [0:0]

                   35
1 row selected
SQL>
```

This example uses a CANDIDATES table where the LAST_NAME column is an indexed VARCHAR type. Observe that the LIKE was transformed to an equals condition that enabled a direct index lookup.

```
SQL> select last_name, first_name
cont> from CANDIDATES
cont>  where last_name like 'Wilson';
Tables:
  0 = CANDIDATES
Leaf#01 FFirst 0:CANDIDATES Card=3
  Bool: (0.LAST_NAME = 'Wilson') AND (OCTET_LENGTH (0.LAST_NAME) = 6)
  BgrNdx1 CAND_LAST_NAME [1:1] Fan=12
    Keys: 0.LAST_NAME = 'Wilson'
 LAST_NAME        FIRST_NAME
 Wilson           Oscar
1 row selected
```

The RDMS$SET_FLAGS logical name or the SQL SET FLAGS statement can disable this default behavior by using the 'NOREWRITE(LIKE)' keywords. The default is SET FLAGS 'REWRITE(LIKE)'.

13.1.5 Additional Database Storage Area Checks

In rare cases generally involving concealed logical names or in a cluster environment, it was possible to construct cases where two physical databases could access the same storage area file in an uncoordinated fashion. This access could lead to data corruption.

The steps required for this type of uncoordinated access would include a database restore or copy likely in a cluster environment. Because the databases shared the same original creation time stamp, so too would the storage area. Oracle Rdb would not detect that the storage areas were for physically separate databases.

This problem has been corrected in Oracle Rdb Release 7.2.5. Oracle Rdb now stores a time stamp of the physical database creation (via copy, restore or create) in the database root file and each storage area file. Each new access to a storage area compares the time stamp of the database root file and the storage area file to further ensure that they are part of the same physical database. If a mismatch is detected, the message INVDBSFIL "inconsistent storage area file" is signaled.

13.1.6 New Optimizations for the STARTING WITH Predicate

This release of Oracle Rdb will try to rewrite the STARTING WITH predicate when the STARTING WITH string is a literal. This enhancement allows Rdb to simplify some STARTING WITH expressions resulting in better index use and usually reducing I/O and CPU time requirements for these queries.

- When the STARTING WITH string is a zero length literal value then it will cause the STARTING WITH to match all non−NULL values. This can cause an unnecessary favoring of an index lookup which consumes CPU time with little advantage to the application.
- When the STARTING WITH string literal is the exact length of the source expression then complete non−NULL values are selected and Rdb can replace the STARTING WITH with an equality (=) predicate.

```
SQL> select last_name, first_name
cont> from employees
cont> where last_name starting with 'Smith         ';
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: 0.LAST_NAME = 'Smith         '
  BgrNdx1 EMPLOYEES_LAST_NAME [1:1] Fan=12
    Keys: 0.LAST_NAME = 'Smith         '
 LAST_NAME        FIRST_NAME
 Smith            Terry
 Smith            Roger
2 rows selected
```

The RDMS$SET_FLAGS logical name or the SQL SET FLAGS statement can disable this default behavior by using the 'NOREWRITE(STARTING_WITH)' keywords. The default is SET FLAGS 'REWRITE(STARTING_WITH)';

13.1.7 New Optimizations for the CONTAINING Predicate

This release of Oracle Rdb will try to rewrite the CONTAINING predicate when the CONTAINING string is a literal value. This enhancement allows Rdb to simplify some CONTAINING expressions resulting in better

index use and usually reducing I/O and CPU time requirements for these queries.

- When the CONTAINING string is a zero length literal value then it will cause the CONTAINING to match all non−NULL values. This can consume CPU time with little advantage to the application. This is replaced by a semantically equivalent OCTET_LENGTH function reference.

The RDMS$SET_FLAGS logical name or the SQL SET FLAGS statement can disable this default behavior by using the 'NOREWRITE(CONTAINING)' keywords. The default is SET FLAGS 'REWRITE(CONTAINING)'.

13.1.8 Monitor Memory Management Enhancements

Previously, the Oracle Rdb Monitor (RDMMON) process would map each database global (TROOT) section into P0 virtual address space. This could, in some cases, consume a significant portion of the 1GB available space and could also result in the virtual address space becoming sufficiently fragmented such that the monitor would be unable to open a database.

As a possible workaround, the monitor process can be restarted.

The impact of this virtual memory fragmentation has been somewhat reduced. The Oracle Rdb Monitor (RDMMON) process now maps database global sections (those that use SHARED MEMORY IS PROCESS or SHARED MEMORY IS PROCESS RESIDENT) into 64−bit P2 virtual address space. In addition, on OpenVMS Integrity Server systems, the executable code of the Oracle Rdb Monitor (RDMMON) process is mapped into 64−bit P2 virtual address space further reducing the amount of P0 virtual address space consumed.

13.1.9 Average Transaction Duration Display Precision Increased

As systems and applications become faster, it is more common for transaction durations of less than .0000 seconds to be performed. Currently, it is not possible to accurately determine, with the RMU /SHOW STATISTICS utility, the average duration of such rapid transactions. This condition has been addressed.

The average transaction duration value on the "Transaction Duration" display of the RMU /SHOW STATISTICS utility has been increased in precision from 4 to 6 fractional digits and the output display slightly modified to fit into an 80 column display, as in the following example.

```
Node: RDBTUK (1/1/1) Oracle Rdb V7.2−50 Perf. Monitor 29−SEP−2010 23:10:29.65
Rate: 3.00 Seconds     Transaction Duration (Total)      Elapsed: 00:00:26.77
Page: 1 of 1          DISK$TUKWILA7:[DB.V72]FOO.RDB;1            Mode: Online
−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−
Total transaction count:            771
Seconds Tx.Count:   %  #Complete:   % #Incomplete:   %
 0−< 1:       773 100%         773 100%            0   0% <−avg=0.000192 95%=0.0
 1−< 2:         0   0%           0   0%            0   0%
 2−< 3:         0   0%           0   0%            0   0%
 3−< 4:         0   0%           0   0%            0   0%
 4−< 5:         0   0%           0   0%            0   0%
 5−< 6:         0   0%           0   0%            0   0%
 6−< 7:         0   0%           0   0%            0   0%
 7−< 8:         0   0%           0   0%            0   0%
 8−< 9:         0   0%           0   0%            0   0%
```

```
 9-<10:         0   0%          0   0%           0   0%
 10+++:         0   0%          0   0%           0   0%
```

13.1.10 Support for New CONCAT_WS Builtin Function

This release of Oracle Rdb adds support for a new builtin function, CONCAT_WS, which is a variation of the CONCAT function. This function uses the first parameter as a separator which is applied after each of the other parameters. For instance, to create a comma separated list of column values, you specify the separator once and have SQL perform the formatting. This is shown in the example below.

```
SQL> select CONCAT_WS (', ', employee_id, birthday, '',
cont>                   last_name, middle_initial, last_name)
cont> from employees
cont> order by employee_id
cont> fetch first 10 rows only;

 00164, 1947-03-28, , Toliver       , A, Toliver
 00165, 1954-05-15, , Smith         , D, Smith
 00166, 1954-03-20, , Dietrich      , Dietrich
 00167, 1937-03-05, , Kilpatrick    , Kilpatrick
 00168, 1932-10-23, , Nash          , Nash
 00169, 1938-08-13, , Gray          , O, Gray
 00170, 1957-06-03, , Wood          , Wood
 00171, 1932-01-29, , D'Amico       , D'Amico
 00172, 1951-05-31, , Peters        , K, Peters
 00173, 1927-03-05, , Bartlett      , G, Bartlett
10 rows selected
SQL>
```

Usage Notes

- If the separator value expression resolves to NULL, then the result of CONCAT_WS will be NULL.
- If any other parameter value expression resolves to NULL, then it will be ignored. That is, that column value and any separator will not be included in the output.
- The function CONCAT_WS accepts all data types with the exception of LIST OF BYTE VARYING, LONG, and LONG RAW. Each non-character string value will be implicitly converted to VARCHAR with a size appropriate for the data type.
  The result of this function will have the type VARCHAR with a length long enough for the concatenated data and separators.
- If dialect ORACLE LEVEL1 or ORACLE LEVEL2 is used, then zero length strings ('') will be considered as NULL and so be excluded from the output. If the resulting value is a zero length string, then the result of CONCAT_WS will be NULL.

Examples

This example shows the use of the CONCAT_WS function to simplify the formatting of table data in CSV (comma separated value) format.

```
SQL> select '"' ||
cont> CONCAT_WS ('", "', first_name, nvl(middle_initial,''), last_name)
cont> || '"'
cont> from employees
cont> order by employee_id;
```

```
 "Alvin     ", "A", "Toliver       "
 "Terry     ", "D", "Smith         "
 "Rick      ", "", "Dietrich      "
 "Janet     ", "", "Kilpatrick    "
...
 "Peter     ", "", "Blount        "
 "Johanna   ", "P", "MacDonald     "
 "James     ", "Q", "Herbener      "
100 rows selected
SQL>
```

13.1.11 New SYSTIMESTAMP Function Added

This release of Oracle Rdb includes a new SYSTIMESTAMP function that returns the current date and time as a TIMESTAMP type. This function is similar to SYSDATE and CURRENT_TIMESTAMP however its type doesn't change when the SET DEFAULT DATE FORMAT command is used.

Syntax

SYSTIMESTAMP [(fractional−seconds−precision)]

Usage Notes

- The function name can be followed by an optional fractional−seconds−precision. This value, if omitted, defaults to 2 and accepts the values 0, 1, or 2.
- The following example shows that SYSTIMESTAMP always returns a SQL standard date and time.

```
SQL> select systimestamp,sysdate,current_timestamp from rdb$database;

 2007−03−27 16:33:32.19   27−MAR−2007 16:33:32.19   27−MAR−2007 16:33:32.19
1 row selected
SQL> set default date format 'sql99';
SQL> select systimestamp,sysdate,current_timestamp from rdb$database;

 2007−03−27 16:33:41.32   2007−03−27 16:33:41.32   2007−03−27 16:33:41.32
1 row selected
SQL>
```

13.1.12 New SET FLAGS Keyword to Control Optimizer Query Rewrite

This release of Oracle Rdb introduces several query rewrite optimizations. These optimizations are enabled by default and can be controlled using the RDMS$SET_FLAGS logical name or the SET FLAGS statement.

The following keywords or keyword parameters can be used. Note that REWRITE, unlike many other SET FLAGS keywords, does not accept a numeric value.

- REWRITE − when no parameters are provided, all query rewrite optimizations are enabled.
- NOREWRITE − when no parameters are provided, all query rewrite optimizations are disabled.
- REWRITE(LIKE), NOREWRITE(LIKE) − specifying the LIKE keyword will enable or disable only the LIKE predicate rewrite.

- REWRITE(STARTING_WITH), NOREWRITE(STARTING_WITH) − specifying the STARTING_WITH keyword will enable or disable only the STARTING WITH predicate rewrite.
- REWRITE(CONTAINING), NOREWRITE(CONTAINING) − specifying the CONTAINING keyword will enable or disable only the CONTAINING predicate rewrite.
- When SET FLAGS 'NONE' or SET NOFLAGS is used, the default setting for REWRITE will be restored.

The following example uses SET and SHOW FLAGS to show the effect of using the NOREWRITE keyword.

```
SQL> set line length 70
SQL> show flags;

Alias RDB$DBHANDLE:
Flags currently set for Oracle Rdb:
   PREFIX,WARN_DDL,INDEX_COLUMN_GROUP,MAX_SOLUTION,MAX_RECURSION(100)
   ,REWRITE(CONTAINING),REWRITE(LIKE),REWRITE(STARTING_WITH)
   ,REFINE_ESTIMATES(127),NOBITMAPPED_SCAN
SQL>
SQL> set flags 'norewrite';
SQL> show flags;

Alias RDB$DBHANDLE:
Flags currently set for Oracle Rdb:
   PREFIX,WARN_DDL,INDEX_COLUMN_GROUP,MAX_SOLUTION,MAX_RECURSION(100)
   ,REFINE_ESTIMATES(127),NOBITMAPPED_SCAN
SQL>
```

13.1.13 New SYS_GUID Function Added

This release of Oracle Rdb supports a new builtin function, SYS_GUID. This function returns a 16 octet globally unique identifier. Applications would use this to provide unique values from various applications and across databases in an OpenVMS cluster or network.

Syntax

SYS_GUID ( )

Usage Notes

- This function uses the OpenVMS system service SYS$CREATE_UID. Applications that call this system service create compatible values for Rdb.
- The returned value from SYS_GUID() may contain octets that are zero. If returning values to C applications, then Oracle recommends using the $SQL_VARCHAR pseudo−type to avoid C null terminated string semantics.
- The SYS_GUID() returns data using a special character set. This special character set is used by Oracle Rdb to distinguish this type of string from others. Interactive SQL will format the value using standard OpenVMS formatting services when this character set is seen. Note that these services perform reordering of the octet values during formatting. That is, the value is not a direct hexadecimal representation of the value.
  Database administrators can define a domain to be used by applications which will make it easier to use.

  ```
  SQL> create domain GUID_DOMAIN
  ```

```
cont>    char(16) character set −11;
SQL>
SQL show domain GUID_DOMAIN;
GUID_DOMAIN                     CHAR(16)
         GUID 16 Characters,  16 Octets
SQL>
```

This domain can be used for column, parameter, and variable definitions.

- To support storing literal GUID values, SQL also supports GUID literals. The literals follow the standard literal format using the special prefix _GUID, as shown in the following examples.

```
SQL> create domain GUID_DOMAIN
cont>    char(16) character set −11;
SQL> show domain GUID_DOMAIN;
GUID_DOMAIN                     CHAR(16)
         GUID 16 Characters,  16 Octets

SQL> create table SAMPLE
cont>     (a int
cont>     ,b GUID_DOMAIN default _guid'00000000−0000−0000−0000−000000000000');
SQL> insert into SAMPLE default values;
1 row inserted

SQL> show table (column) SAMPLE;
Information for table SAMPLE

Columns for table SAMPLE:
Column Name                     Data Type        Domain
−−−−−−−−−−−                     −−−−−−−−−        −−−−−−
A                               INTEGER
B                               CHAR(16)         GUID_DOMAIN
         GUID 16 Characters,  16 Octets
 Oracle Rdb default: GUID'00000000−0000−0000−0000−000000000000'
SQL>
```

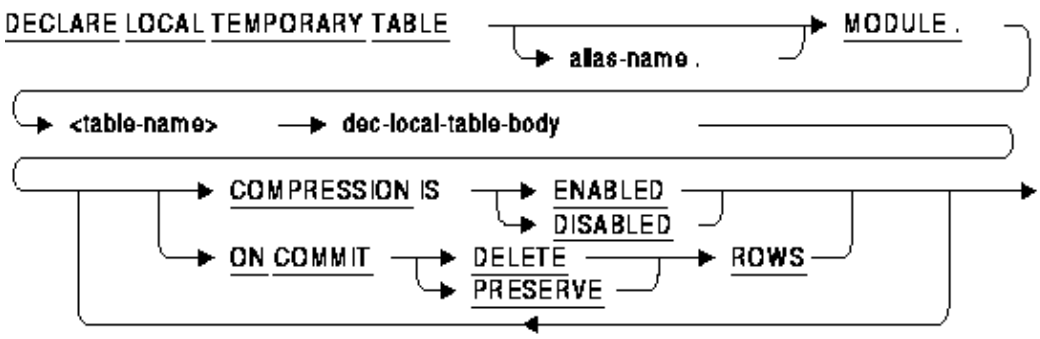
The literal can also be used in queries to select existing rows.

```
SQL> select * from SAMPLE
cont> where b = _guid'3DBB657F−8513−11DF−9B74−0008029189E7';
```

13.1.14 New COMPRESSION Clause for DECLARE LOCAL TEMPORARY TABLE Statement

This release of Oracle Rdb enhances the DECLARE LOCAL TEMPORARY TABLE syntax with a new COMPRESSION option. In prior releases of Rdb, it was not possible to disable row compression for temporary tables even though doing so might save some compression and decompression CPU time overhead. In addition, if the data in the temporary table is not compressible, it is possible that the run−length encoding could increase the resulting row length.

Syntax



Parameters

- COMPRESSION IS ENABLED
  COMPRESSION IS DISABLED
  This clause controls the use of run−length compression for rows inserted into this local temporary table. The default is COMPRESSION IS ENABLED.

Usage Notes

- In some cases, the data inserted into a local temporary table may not compress and so incur only overhead in the row. This overhead is used by Rdb to describe the sequence of uncompressible data. Use COMPRESSION IS DISABLED to prevent Rdb from attempting the compression of such data.

Examples

The following example shows a declared local temporary table that will not benefit from compression. The clause COMPRESSION IS DISABLED is used to reduce the CPU overhead for the table as well as preventing a possible row size increase because of compression notations.

```
SQL> declare local temporary table module.scratch0
cont>     (averages double precision)
cont>     compression is DISABLED
cont>     on commit PRESERVE rows
cont> ;
SQL>
SQL> insert into module.scratch0
cont>     select avg (char_length (a)) from module.scratch1;
1 row inserted
SQL>
SQL> select * from module.scratch0;
                AVERAGES
  2.100000000000000E+001
```

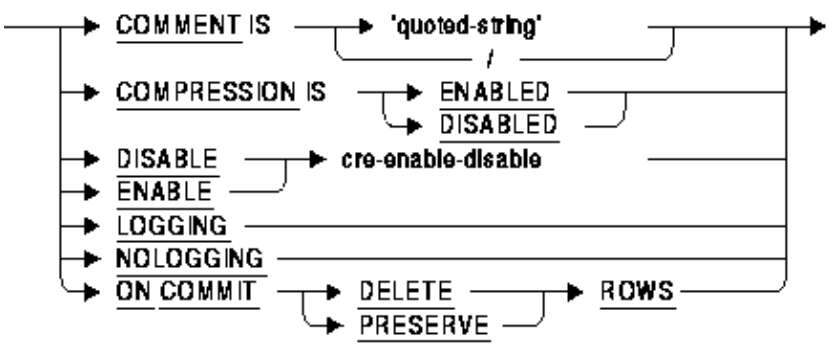
13.1.15 New COMPRESSION Clause for CREATE TABLE Statement

In prior releases of Rdb, it was required that a storage map be created for the table so that row compression

could be disabled. This release of Oracle Rdb enhances the CREATE TABLE syntax with a new COMPRESSION option.

Syntax

create-table-attributes =



Parameters

- COMPRESSION IS ENABLED
  COMPRESSION IS DISABLED
  This clause controls the use of run−length compression for rows inserted into this base or temporary table. The default is COMPRESSION IS ENABLED.

Usage Notes

- In some cases, the data inserted into a table may not compress and so incur only overhead in the row. This overhead is used by Rdb to describe the sequence of uncompressible data. Use COMPRESSION IS DISABLED to prevent Rdb from attempting the compression of such data.
- Any storage map which specifies the ENABLE COMPRESSION or DISABLE COMPRESSION clause will override this setting in the table.
- The COMPRESSION IS clause is not permitted for INFORMATION tables.

Examples

The following example shows that compression was disabled for the created table. The SHOW TABLE statement reports the disabled (that is the non−default) setting for compression.

```
SQL> create table SAMPLE
cont> (ident integer identity
cont> ,sample_value real
cont> )
cont> compression is disabled;
SQL> show table SAMPLE
Information for table SAMPLE

Compression is disabled.
Columns for table SAMPLE:
Column Name                    Data Type        Domain
```

```
-----------                     ---------       ------
IDENT                           INTEGER
 Computed:      IDENTITY
SAMPLE_VALUE                    REAL

Table constraints for SAMPLE:
 No Constraints found

Constraints referencing table SAMPLE:
 No Constraints found

Indexes on table SAMPLE:
 No Indexes found

Storage Map for table SAMPLE:
 No Storage Map found

Triggers on table SAMPLE:
No triggers found

SQL>
```

13.1.16 Support for 2 TiB Storage Area Files

OpenVMS Version 8.4 provides support for disk volumes up to 2 TiB in size. The precise maximum volume size is 4,261,348,350 blocks, which is about 1.98 TiB. Oracle Rdb now supports live and snapshot storage areas with up to 2,147,483,647 database pages and up to the OpenVMS Version 8.4 file size limit of 4,261,348,350 blocks. In order to utilize a database storage area of more than 2,147,483,647 disk blocks (approximately 1 TiB), a database page size of greater than 1 is required; in all cases, a database storage area is limited to 2,147,483,647 pages.

For Oracle Rdb Release 7.2.5, 2 TiB file support is limited to live and snapshot storage areas. Future Oracle Rdb releases are expected to expand this support to cover additional on−disk component files.

Note

The tebibyte is a standards−based binary multiple (prefix tebi, symbol Ti) of the byte, a unit of digital information storage. The tebibyte unit symbol is TiB.

```
1 tebibyte = 2^40 bytes = 1099511627776 bytes = 1024 gibibytes
```

The tebibyte is closely related to the terabyte, which is defined as 10^12 bytes or 1000000000000 bytes, but has been used as a synonym for tebibyte in some contexts.

13.1.17 New RMU/ALTER Feature to Modify the Root and Area Header Unique Identifier

To ensure Oracle Rdb database security and integrity, a Unique Identifier has been added to the database root file and the database storage area file and storage area snapshot file headers. The Unique Identifier in the root

file must match the Unique Identifier in the storage area file headers or a storage area cannot be accessed from the database root. The RMU/ALTER command has been enhanced to allow a Database Administrator to modify and display the database root and storage area Unique Identifier values to prevent problems which will occur if these values are corrupted.

The Unique Identifier values are displayed both in VMS date format surrounded by quotes and as a hexadecimal number surrounded by parentheses. The values displayed are the Unique Identifier values for the current RMU/ALTER session. The Unique Identifier values will not be written to the root or storage area files until the user ends the current session with the RMU/ALTER "COMMIT" command. If the user ends the current session with the RMU/ALTER "ROLLBACK" command, the Unique Identifier values will not be written to the root or storage area files and the Unique Identifier values in effect at the start of the session just ended will be restored for the new session. Any Unique Identifier values that have been changed during the current session will be displayed as "(marked)" before they are committed or rolled back.

The new syntax, which can only be used at the "RdbALTER>" prompt which appears when the RMU/ALTER command is issued at the VMS prompt, is the following where "name" is the storage area name and "id" is the storage area identification number in the database root file. "AREA_HEADER" refers to the storage area file header. "ROOT" refers to the Rdb database root file (*.RDB). "UNIQUE_IDENTIFIER" refers to the Unique Identifier in the storage area header when used with "AREA_HEADER" and to the Unique Identifier in the database root when used with "ROOT". If "SNAPSHOT" is not specified, the storage area (*.RDA) file is assumed. If "SNAPSHOT" is specified, the snapshot storage area (*.SNP) file is assumed. The user cannot specify a new "UNIQUE_IDENTIFIER" value: it must be created by RMU/ALTER.

```
DISPLAY ROOT UNIQUE_IDENTIFIER
```

This command displays the current database root Unique Identifier value.

```
DEPOSIT ROOT UNIQUE_IDENTIFIER (= NEW)
```

If "= NEW" is not specified, this command stores the current database root Unique Identifier value into the storage area header blocks of ALL active storage area and storage area snapshot files which are currently defined in the database root when the user executes the next COMMIT command. If "= NEW" is specified, a new Unique Identifier value is created and stored in both the root file and ALL active storage area file headers when the user executes the next COMMIT command. Note that to ensure database integrity, ALL storage area file headers will be updated. Use the AREA_HEADER commands described below for storing the current root Unique Identifier value in specific designated storage areas.

```
DISPLAY AREA_HEADER {name|id} (SNAPSHOT) UNIQUE_IDENTIFIER
```

This command displays the current storage area file or storage area snapshot file header Unique Identifier value for the storage area with the specified name or number.

```
DEPOSIT AREA_HEADER {name|id} (SNAPSHOT) UNIQUE_IDENTIFIER
```

This command stores the current database root Unique Identifier value into the current storage area file or storage area snapshot file header for the storage area with the specified name or number when the user executes the next COMMIT command.

As stated above, any changes to the area header or root Unique Identifier values will only be written to the actual root and area files when the next "COMMIT" command is executed at the "RdbALTER>" prompt. Any changes to the root or area file headers since the last "COMMIT" command was issued can be undone by

executing the "ROLLBACK" command at the "RdbALTER>" prompt. "COMMIT" and "ROLLBACK" are existing RMU/ALTER commands and affect any current uncomitted changes made in RMU/ALTER, not just changes to the root and storage area header Unique Identifier values.

To execute the DISPLAY or DEPOSIT ROOT or AREA_HEADER command, the user must be attached to the database which the root and areas belong to, either by specifying the database name when issuing the RMU/ALTER command or by executing the "ATTACH" command from the "RdbALTER>" prompt.

The following example shows that for Oracle Rdb single file databases, the Unique Identifier value can only be set for the storage area snapshot file since the storage area is part of the root file. Therefore, the DEPOSIT AREA_HEADER command can only specify the "SNAPSHOT" file or an error will be returned.

```
$ RMU/ALTER PERSONNEL
%RMU-I-ATTACH, now altering database
"DEVICE:[DIRECTORY]PERSONNEL.RDB;1"
  DEPOSIT AREA_HEADER RDB$SYSTEM UNIQUE_IDENTIFIER
%RMU-F-NOTSFDB, This command is not allowed for a single file
 database
  DEPOSIT AREA_HEADER RDB$SYSTEM SNAPSHOT UNIQUE_IDENTIFIER
Area RDB$SYSTEM:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:29.32"
 (00AA557869612643)

 COMMIT
 EXIT
```

Since the DEPOSIT ROOT UNIQUE_IDENTIFIER command always stores the Unique Identifier value in ALL storage area file headers when the user executes the RMU/ALTER "COMMIT" command, it would be redundant to execute the DEPOSIT AREA_HEADER UNIQUE_IDENTIFIER command if a DEPOSIT ROOT UNIQUE_IDENTIFIER command is already pending for the current RMU/ALTER session. Therefore, as the following example shows, in this case a DEPOSIT AREA_HEADER UNIQUE_IDENTIFIER command cannot be executed until the user ends the current session with a COMMIT or ROLLBACK command.

```
$ RMU/ALTER MF_PERSONNEL
%RMU-I-ATTACH, now altering database
 "DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1"
  DEPOSIT ROOT UNIQUE_IDENTIFIER = NEW
(marked) Root file unique identifier is: "22-OCT-2010 13:49:31.72"
 (00AA55786ACFB115)

  DEPOSIT AREA_HEADER SALARY_HISTORY UNIQUE_IDENTIFIER
%RMU-F-COMROOTCOM, COMMIT or ROLLBACK DEPOSIT ROOT
 UNIQUE_IDENTIFIER command to use this command
  commit
  DEPOSIT AREA_HEADER SALARY_HISTORY UNIQUE_IDENTIFIER
Area SALARY_HISTORY:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:31.72"
 (00AA55786ACFB115)

  COMMIT
  EXIT
```

The following example shows that RMU/ALTER is invoked specifying the database MF_PERSONNEL.RDB. The user then displays the current Unique Identifier value in the database root, creates a new Unique Identifier value in the database root, displays the new Unique Identifier in the root, and

finally specifies "commit" to write the new Unique Identifier value to the database root file and ALL database storage area files. The display messages designate the pending new Unique Identifier value as "(marked)" until the user either executes "commit" to write out the new Unique Identifier value or "rollback" to restore the original Unique Identifier value. The user then verifies the database changes.

```
$ RMU/ALTER MF_PERSONNEL
%RMU-I-ATTACH, now altering database "DISK:[DIRECTORY]MF_PERSONNEL.RDB;1"
  DISPLAY ROOT UNIQUE_IDENTIFIER
         Root file unique identifier is: "22-OCT-2010 13:49:27.87"
 (00AA5578688428BB)
  DEPOSIT ROOT UNIQUE_IDENTIFIER = NEW
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)
  DISPLAY ROOT UNIQUE_IDENTIFIER
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)
  COMMIT
  EXIT
$ RMU/VERIFY/ALL/NOLOG MF_PERSONNEL
```

The following example shows that RMU/ALTER is invoked specifying the database MF_PERSONNEL.RDB. The user then displays the current Unique Identifier value in the root file. He then executes the "deposit" commands to designate that the Unique Identifer value in the root file is to be moved to the DEPARTMENTS area storage and the DEPARTMENTS area snapshot files, displays the Unique Identifier value that is to be moved to the DEPARTMENTS area storage and the DEPARTMENTS area snapshot files, and finally specifies "commit" to actually write the root unique identifier value to the DEPARTMENTS area storage and the DEPARTMENTS area snapshot files. The display messages designate the pending Unique Identifier value as "(marked)" until the user either executes "commit" to write out the Unique Identifier value or "rollback" to restore the original Unique Identifier value. The user then verifies the database changes. The example shows that the user can use either the storage area name or the storage area identifier number in the root to designate the target storage area.

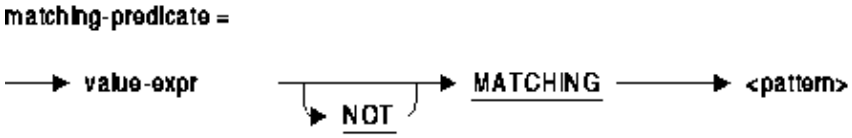
```
$ RMU/ALTER MF_PESONNEL
%RMU-I-ATTACH, now altering database "DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1"
  DISPLAY ROOT UNIQUE_IDENTIFIER
           Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)

  DEPOSIT AREA_HEADER DEPARTMENTS UNIQUE_IDENTIFIER
Area DEPARTMENTS:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)

  DEPOSIT AREA_HEADER 2 SNAPSHOT UNIQUE_IDENTIFIER
Area DEPARTMENTS:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)

  DISPLAY AREA_HEADER DEPARTMENTS UNIQUE_IDENTIFIER
Area DEPARTMENTS:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)

  DISPLAY AREA_HEADER 2 SNAPSHOT UNIQUE_IDENTIFIER
Area DEPARTMENTS:
(marked) Root file unique identifier is: "22-OCT-2010 13:49:28.34"
 (00AA557868CC9F7A)
```

```
  COMMIT
  EXIT
$ RMU/VERIFY/ALL/NOLOG MF_PERSONNEL
```

13.1.18 New MATCHING Predicate

This release of Oracle Rdb supports MATCHING as an alternate string pattern matching clause.

Syntax



A MATCHING predicate searches character string literals for pattern matches. The pattern string accepts the following pattern characters:

- * Matches any string of zero or more characters
- % Matches any single character

Usage Notes

- If either of the expressions is null, the result is null.
- The MATCHING predicate is not case sensitive; it considers uppercase and lowercase forms of the same character to be a match.
- The MATCHING predicate is not sensitive to diacritical markings used in the DEC Multinational Character Set.

The following example shows the use of the MATCHING clause.

```
SQL> select last_name
cont> from employees
cont> where last_name matching '%on*';
 LAST_NAME
 Connolly
 Lonergan
2 rows selected
SQL>
```

13.1.19 New RMU/BACKUP−RESTORE Feature to Check Database Page Integrity

To ensure Oracle Rdb database integrity, a new feature has been added to the RMU/BACKUP and RMU/RESTORE commands to do a basic integrity check of AIP, ABM and data storage area pages when they are backed up and when they are restored. SPAM pages are not backed up by RMU/BACKUP but recreated by RMU/RESTORE based on the page types that are backed up. This basic integrity check will always happen in order to prevent database corruption.

The basic page checks made are not intended to replace an RMU/VERIFY of the database pages before they are backed up or after they are restored. If the page checks report problems, the user should immediately do an RMU/VERIFY of the storage area to get a complete evaluation of the detected problems and any additional problems that may exist. The page checks made are intended to cause minimal additional overhead to the backup or restore operation while indicating serious page corruption exists that needs to be investigated using the RMU/VERIFY and/or RMU/DUMP commands and then corrected. The page checks are necessary so that page integrity problems can be detected and fixed at backup time or so that page integrity problems can be reported and fixed after the restore.

The checks made are a check for a valid storage area id number on the page, a check for a non−zero timestamp on the page, and a check for a page number that is greater than zero and less than or equal to the maximum page number for the storage area. The diagnostic messages output are the same as the diagnostic messages output by RMU/VERIFY if these problems are detected. For RMU/BACKUP, the backup is aborted if any of these checks fail so that the problem can be fixed at backup time. For RMU/RESTORE, the restore will be aborted only if the page number check fails since RMU/RESTORE cannot continue in this case. The other problems will be reported but the backup will continue so the problems can then be fixed in the restored database. Neither the backup or restore operation will be aborted until all the specified checks have been made.

The following example shows that the backup command is aborted because of a page with an invalid page number in storage area SALARY_HISTORY. An RMU/VERIFY of the database gives the additional information of the expected page number where the invalid page number of zero occurs.

```
$ RMU/BACKUP/NOLOG MF_PERSONNEL.RDB MFP.RBF
%RMU−E−BADPAGRAN, area SALARY_HISTORY
%RMU−E−BADPAGRA2,                   page number 0 out of range
%RMU−E−BADPAGRA3,                   expected between 1 and 706
%RMU−F−INVPAGAREA, Aborting command − invalid page 0 in area SALARY_HISTORY
%RMU−F−FATALERR, fatal error on BACKUP
%RMU−F−FTL_BCK, Fatal error for BACKUP operation at 21−DEC−2010
 09:30:19.64
$ rmu/verify/all/nolog mf_personnel
%RMU−W−PAGPAGRAN, area SALARY_HISTORY, page 21
                  page number out of range
                  expected: 21, found: 0
```

The following database backup example shows all three diagnostics that can be put out by the basic page validation checks. If any of these checks fail, the backup operation will be aborted.

```
$ RMU/BACKUP/NOLOG MF_PERSONNEL.RDB MFP.RBF
%RMU−W−PAGBADARE, area RDB$SYSTEM, page 0
%RMU−W−PAGBADAR2,                   maps incorrect storage area
%RMU−W−PAGBADAR3,                   expected: 1, found: 3
%RMU−W−PAGTADZER, area RDB$SYSTEM, page 0
```

```
%RMU-W-PAGTADZE2,                   contains zero time stamp
%RMU-E-BADPAGRAN, area RDB$SYSTEM
%RMU-E-BADPAGRA2,                   page number 0 out of range
%RMU-E-BADPAGRA3,                   expected between 1 and 1012
%RMU-F-INVPAGAREA, Aborting command - invalid page 0 in area RDB$SYSTEM
%RMU-F-FATALERR, fatal error on BACKUP
%RMU-F-FTL_BCK, Fatal error for BACKUP operation at 21-DEC-2010 09:39:21.64
```

The following database restore example shows all three diagnostics that can be put out by the basic page validation checks. The restore operation will be aborted only if the page number is invalid but the other reported problems must be corrected.

```
$ RMU/RESTORE/NOLOG/NOCDD MFP.RBF
%RMU-W-PAGBADARE, area RDB$SYSTEM, page 0
%RMU-W-PAGBADAR2,                   maps incorrect storage area
%RMU-W-PAGBADAR3,                   expected: 1, found: 3
%RMU-W-PAGTADZER, area RDB$SYSTEM, page 0
%RMU-W-PAGTADZE2,                   contains zero time stamp
%RMU-E-BADPAGRAN, area RDB$SYSTEM
%RMU-E-BADPAGRA2,                   page number 0 out of range
%RMU-E-BADPAGRA3,                   expected between 1 and 1012
RMU-F-INVPAGAREA, Aborting command - invalid page 0 in area RDB$SYSTEM
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 21-DEC-2010 09:44:01.96
```

13.1.20 New RMU/DUMP/BACKUP /AREA, /START and /END Qualifiers

New /AREA, /START and /END qualifiers have been added to the Oracle Rdb RMU/DUMP/BACKUP command which dumps the contents of an Rdb database backup (*.RBF) file. These qualifiers allow the user to dump backup file records for a specified storage area and for a specified range of pages within the specified storage area.

The syntax for the new qualifiers used with the RMU/DUMP/BACKUP command is the following.

```
/AREA = identity
```

Only dump the storage area identified by the specified name or ID number. The area name must be the name of a storage area in the database root file and the area ID number must be a storage area ID number in the database root file. This information is contained in the "Database Parameters:" section of the backup file which is output at the start of the dump. Snapshot areas are not contained in the backup file and cannot be specified. If this qualifier is used without the new /START and /END qualifiers, all page records in the specified storage area will be output.

```
/START = number
```

Only dump pages starting with the specified page number in the specified storage area. This qualifier cannot be used unless the /AREA qualifier is also specified. If no pages are dumped either the specified page or range of pages does not exist in the specified area in the backup file, or this qualifier has been used in the same RMU/DUMP/BACKUP command as an /OPTIONS, /SKIP or /PROCESS qualifier option that has excluded the specified page or range of pages from the dump. If this qualifier is not used with the new /END qualifier, all page records in the specified storage area starting with the specified page number will be output.

```
/END = number
```

Only dump pages ending with the specified page number in the specified storage area. This qualifier cannot be used unless the /AREA qualifier is also specified. If no pages are dumped either the specified page or range of pages does not exist in the specified area in the backup file, or this qualifier has been used in the same RMU/DUMP/BACKUP command as an /OPTIONS, /SKIP or /PROCESS qualifier option that has excluded the specified page or range of pages from the dump. If this qualifier is not used with the new /START qualifier, all page records in the specified storage area ending with the specified page number will be output.

If both the /START and /END qualifiers are specified, the starting page number must be less than or equal to the ending page number. If the starting page number equals the ending page number only the page records for the specified page number are dumped. The block header for each block which contains at least one of the requested pages is dumped followed by the requested page records in that block. The START AREA record is dumped at the start of requested page records and the END AREA record is dumped at the end of the requested page records. By default, the database root parameters are dumped at the very start following the dump header.

The following example shows the dump of the page records for page 10 in storage area 4 in the MFP.RBF backup file. Since the /START and /END qualifiers both specify page 10, only the page records for that page are dumped. At the start of the dump is the dump header, followed by the database root parameters which are not shown to save space, followed by the block header, which begins with the "HEADER_SIZE" field, for the block which contains the records for page 10 in storage area 4, followed by the start area record for area 4 (REC_TYPE = 6), the data page header record (REC_TYPE = 7) for page 10, the data page data record (REC_TYPE = 8) for page 10, and ending with the end area record for area 4 (REC_TYPE = 11) which ends the dump.

```
$ RMU/DUMP/BACKUP/AREA=4/START=10/END=10/OPTION=FULL MFP.RBF
*-------------------------------------------------------------------------------
* Oracle Rdb V7.2-420                                    11-JAN-2011 15:50:09.25
*
* Dump of Database Backup Header
*     Backup filename: MFP.RBF
*     Backup file database version: 7.2
*
*-------------------------------------------------------------------------------


Database Parameters:
.
.
.

HEADER_SIZE = 80        OS_ID = 1024    UTILITY_ID = 722
APPLICATION_TYPE = 1    SEQUENCE_NUMBER = 22    MAJ_VER = 1    MIN_VER = 1
VOL_NUMBER = 1  BLOCK_SIZE = 32256      CRC = 0C5D3A78  NOCRC = 00
CRC_ALTERNATE = 00      BACKUP_NAME = MFP.RBF   AREA_ID = 4    HIGH_PNO = 259
LOW_PNO = 1     HDR_CHECKSUM = 9B3D

REC_SIZE = 2    REC_TYPE = 6    BADDATA = 00    ROOT = 00
AREA_ID = 4     LAREA_ID = 0    PNO = 0

REC_SIZE = 32   REC_TYPE = 7    BADDATA = 00    ROOT = 00
AREA_ID = 4     LAREA_ID = 0    PNO = 10

REC_SIZE = 28   REC_TYPE = 8    BADDATA = 00    ROOT = 00
AREA_ID = 4     LAREA_ID = 0    PNO = 10
```

```
REC_SIZE = 512  REC_TYPE = 11   BADDATA = 00    ROOT = 00
AREA_ID = 4     LAREA_ID = 0    PNO = 0
```

The following example dumps the records for pages 10, 11 and 12 in the RDB$SYSTEM storage area in the MFP.RBF backup file. Following the block header containing the target records that starts with "HEADER_SIZE =", are the start area record for RDB$SYSTEM area 1 (REC_TYPE = 6), then the target ABM page records for pages 10, 11, and 12 (REC_TYPE = 10), and finally the end area record for area RDB$SYSTEM area 1 (REC_TYPE = 11) which ends the dump.

```
$ RMU/DUMP/BACKUP/AREA=RDB$SYSTEM/START=10/END=12/OPTION=FULL MFP.RBF
*-------------------------------------------------------------------------------
* Oracle Rdb V7.2-420                                    14-JAN-2011 14:40:46.88
*
* Dump of Database Backup Header
*     Backup filename: MFP.RBF
*     Backup file database version: 7.2
*
*-------------------------------------------------------------------------------

Database Parameters:
.
.
.

HEADER_SIZE = 80        OS_ID = 1024    UTILITY_ID = 722
APPLICATION_TYPE = 1    SEQUENCE_NUMBER = 1     MAJ_VER = 1     MIN_VER = 1
VOL_NUMBER = 1  BLOCK_SIZE = 32256      CRC = 8329C24B  NOCRC = 00
CRC_ALTERNATE = 00      BACKUP_NAME = MFP.RBF   AREA_ID = 1     HIGH_PNO = 178
LOW_PNO = 1     HDR_CHECKSUM = 40DE

REC_SIZE = 2    REC_TYPE = 6    BADDATA = 00    ROOT = 00       AREA_ID = 1
LAREA_ID = 0    PNO = 0

REC_SIZE = 10   REC_TYPE = 10   BADDATA = 00    ROOT = 00       AREA_ID = 1
LAREA_ID = 3    PNO = 10

REC_SIZE = 10   REC_TYPE = 10   BADDATA = 00    ROOT = 00       AREA_ID = 1
LAREA_ID = 4    PNO = 11

REC_SIZE = 10   REC_TYPE = 10   BADDATA = 00    ROOT = 00       AREA_ID = 1
LAREA_ID = 4    PNO = 12

REC_SIZE = 512  REC_TYPE = 11   BADDATA = 00    ROOT = 00       AREA_ID = 1
LAREA_ID = 0    PNO = 0
```

13.1.21 Reduced CPU Usage and Improved Performance

Several performance enhancements have been implemented in this release of Oracle Rdb. Most of these changes are either specific to applications running on I64 systems or will have a greater effect on I64 systems. These enhancements include improved code sequences for:

- Integer and floating point arithmetic operations
- Floating point comparison operations
- Floating point conversion operations

13.1.22 New Logical Name to Control Sizing of LIST OF BYTE VARYING Pointer Segments

This release of Oracle Rdb supports a new logical name, RDMS$BIND_SEGMENTED_STRING_PSEG_SIZING, that can be used to control the upper limit for the size of the pointer segment which is stored for LIST OF BYTE VARYING data.

In prior releases, the upper limit for a pointer segment was the free space on a page. If only a small number of LIST segments were inserted, then the pointer segment was trimmed to that required by the data for that column. However, when many relatively small segments were stored there would be one or more large segments stored that required Rdb to search for free space (essentially a free storage area page). The result was a high number of discarded pages − pages read from disk that contained free space but insufficient free space for the stored pointer segments. The solution is to define THRESHOLD values for the MIXED format storage area, or the LIST storage map for UNIFORM format storage areas so that Rdb has guidance on acceptable pages.

To simplify the management of LIST OF BYTE VARYING data, Rdb now supports this new logical to control INSERT behavior for pointer segments. The logical name RDMS$BIND_SEGMENTED_STRING_PSEG_SIZING can be defined to one of the following numeric values:

- 0
  Use the current page size as the upper limit. This remains the default behavior (as in previous releases) if this logical name is not defined.
- 1
  Use the maximum segment length for the current LIST OF BYTE VARYING column value. For instance, if the application always stored 100 octet values in the LIST then this will be used (plus record overhead) to limit the size of the pointer segments.
- 2
  Use the average segment length for the current LIST OF BYTE VARYING column value. This is a useful setting when segments are of different sizes, such as lines from a text document.

Usage Notes

- If any other value is used for the logical name, then it will be ignored and the setting will default to standard behavior.
- This logical name affects all tables including system tables.
- The effect may be more smaller pointer segments. This will translate to increased I/O counts. However, the benefit should be better placement in the storage area and elimination (or reduction) in discarded pages.
- If the average or maximum length of the data segments is too small, then Rdb will ensure that the pointer segments can store at least three pointers. When stored, the pointer segments will be trimmed to contain only valid data pointers.
- The stored data is compatible with all releases of Oracle Rdb, and the logical can be deassigned or redefined at any time.
- If the logical name RDMS$USE_OLD_SEGMENTED_STRING is defined as "T", "t", or "1" then Rdb will revert to chained style segmented strings. In that case, the value specified by RDMS$BIND_SEGMENTED_STRING_PSEG_SIZING will not be used.

13.1.23 RMU /BACKUP Performance Improvements

RMU /BACKUP performance has been improved by streamlining code sequences and reducing redundant data copies in memory. In some cases, reductions of up to 10% of CPU time have been realized.

13.1.24 New RMU/BACKUP/ENCRYPT "%RMU−I−ENCRYPTUSED" Message Added

The Oracle Rdb RMU/BACKUP/ENCRYPT and RMU/BACKUP/AFTER_JOURNAL/ENCRYPT commands create encrypted Rdb database backup files and Rdb database After Image Journal backup files using an encryption key. The same encryption key must be specified when the database is restored or recovered by the RMU/RESTORE/ENCRYPT and RMU/RECOVER/ENCRYPT commands. The following informational message will now always be output on a successful completion of the RMU/BACKUP/ENCRYPT and RMU/BACKUP/AFTER_JOURNAL/ENCRYPT commands to remind the user that the same key specified for these commands must be specified when the created backup files are restored or recovered by the RMU/RESTORE/ENCRYPT and "RMU/RECOVER/ENCRYPT commands.

```
%RMU−W−ENCRYPTUSED, Encryption key required when future restore
performed.
```

The following example shows this new informational message being put out when successful RMU/BACKUP/ENCRYPT and RMU/BACKUP/AFTER_JOURNAL/ENCRYPT commands are completed.

```
$ RMU/BACKUP/NOLOG database_file backup_file −
 /ENCRYPT=(VALUE=key_name,ALGORITHM=algorithm_name)
%RMU−I−ENCRYPTUSED, Encryption key required when future restore
performed.
$ RMU/BACKUP/AFTER_JOURNAL/FORMAT=NEW_TAPE −
 database_file backup_file −
 /ENCRYPT=(VALUE=key_name,ALGORITHM=algorithm_name)/NOLOG
%RMU−I−ENCRYPTUSED, Encryption key required when future restore
performed.
```

13.1.25 New DATABASE_HANDLE Option for the GET DIAGNOSTICS Statement

This release of Oracle Rdb adds the keyword DATABASE_HANDLE for use by the GET DIAGNOSTICS statement. This option returns a unique handle (or stream) identifier which can be useful in distinguishing one attach from another.

```
SQL> set flags 'trace';
SQL>
SQL> begin
cont> declare :ii integer;
cont> get diagnostics :ii = DATABASE_HANDLE;
cont> trace :ii;
cont> end;
~Xt: 1
SQL>
```

13.1.26 New SYS_GET_DIAGNOSTIC Function Supported for SQL

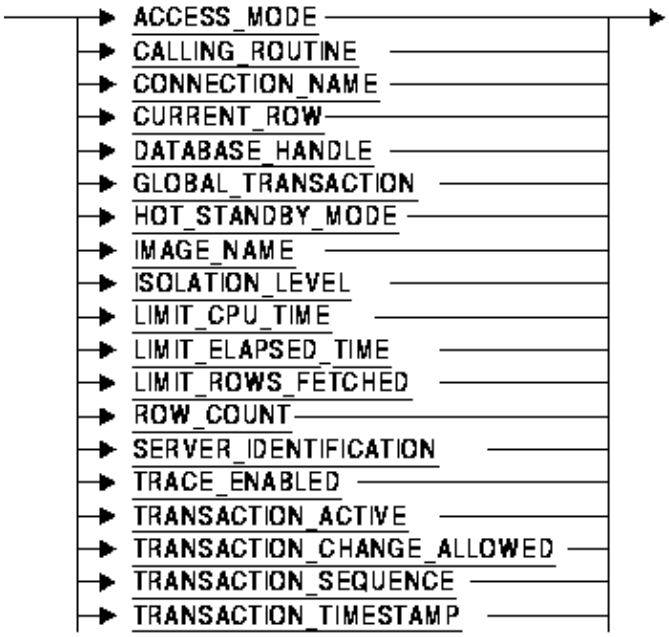
This release of Oracle Rdb adds a new function, SYS_GET_DIAGNOSTIC, that can be used to return the same session information available to the GET DIAGNOSTICS statement. This function provides a shorthand method of fetching values without requiring a compound statement or an intermediate variable.

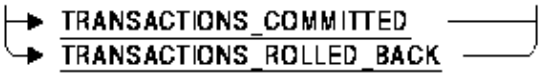
Syntax

SYS_GET_DIAGNOSTIC (statement−item−name)

---

statement-item-name =





Usage Notes

- For the list of keywords acceptable by this function, please see the statement−item−name syntax under the GET DIAGNOSTICS statement.
- Each keyword used with SYS_GET_DIAGNOSTIC will cause the result to have a different associated data type. Please refer to the GET DIAGNOSTICS statement for the returned data types.

Examples

The following example shows the return of session information.

```
SQL> select SYS_GET_DIAGNOSTIC (CONNECTION_NAME) as CONN,
cont>       SYS_GET_DIAGNOSTIC (SERVER_IDENTIFICATION) as IDENT,
cont>       SYS_GET_DIAGNOSTIC (DATABASE_HANDLE) as DBHANDLE
cont>  from GET_DIAG;
 CONN                              IDENT                               DBHANDLE
 RDB$DEFAULT_CONNECTION            Oracle Rdb V7.2−501                    1
1 row selected
SQL>
```

13.1.27 Improved Error Handling for Database Disk Backup File Sets

Bug 4596098

The "/DISK_FILE" command qualifier can be used with certain Oracle Rdb RMU commands such as "RMU/BACKUP" and "RMU/RESTORE" to create or read database disk backup file sets. The error handling for the "/DISK_FILE" qualifier used with the "RMU/RESTORE" and "RMU/DUMP/BACKUP" commands has been improved in the following cases.

If the first file of a backup file set is not specified, the "RMU/RESTORE" or "RMU/DUMP/BACKUP" command cannot continue since the first file of the backup file set contains the backed up root. For this case, a new message has been added which displays the backup command that was used to create the backup file set which is contained in the summary record at the start of each backup file. The backup command will show all the backup files created by the backup in the correct order.

```
%RMU-W-BCKCMDUSED, The backup command was
"RMU/BACKUP...".
```

In addition, a new message has been added to specify that file number "n" in the backup file set, the first backup set file specified in the restore command, is not the first backup file of the backup set created by the backup command.

```
%RMU-E-NOTFIRVOL, Backup set file number n, the first backup file specified,
is not the first file of the backup set. Specify all the backup set files or
devices in the correct order.
```

The following example shows the new error messages for this case. The first backup set file created by the "RMU/BACKUP/DISK_FILE" command, "MFP", is not specified by the "RMU/RESTORE" command.

```
$ RMU/RESTORE/NOLOG/NOCDD/DISK=READER=3 MFP01,MFP02,MFP03
%RMU-W-BCKCMDUSED, The backup command was
"RMU/BACKUP/NOLOG/DISK=WRITER=4 MF_PERSONNEL MFP,MFP01,MFP02,MFP03".
%RMU-E-NOTFIRVOL, Backup set file number 2, the first backup file specified,
is not the first file of the backup set. Specify all the backup set files or
devices in the correct order.
%RMU-F-INVDBBFIL, invalid backup file DEVICE:[DIRECTORY]MFP01.RBF;
%RMU-F-FATALERR, fatal error on RESTORE
%RMU-F-FTL_RSTR, Fatal error for RESTORE operation at 22-MAR-2011 10:04:26.82
```

If the first file of the backup file set is specified but other file(s) of the set are left out, a new message has been added which displays the backup command that was used to create the backup file set which is contained in the summary record at the start of each backup file. This will show all the backup files created by the backup command in the correct order.

```
%RMU-W-BCKCMDUSED, The backup command was
"RMU/BACKUP...".
```

Also, the warning message below has been changed to the following error message.

```
%RMU-W-RESINCOMP, Not all storage areas have been restored
```

```
%RMU-E-RESINCOMP, Not all storage areas have been restored, the
 database may be corrupt.
```

In this case, "%RMU−E−RESINCOMP" has been made the exit status. The restored database can be attached to and the storage areas that were restored can be accessed in SQL without error, though SQL will return an

error if access is attempted to the storage areas in the root that were not restored. The user should delete the restored files and repeat the restore using all the backup files in the backup set displayed in the "%RMU−W−BCKCMDUSED" message. If any of the backup files in the set have been lost, the missing storage areas can be restored by the RMU/RESTORE/AREA command using a previous backup file if it is available.

The new error messages for this case are not put out for the "RMU/DUMP/BACKUP" command since this command can be used to dump one or more files of a backup set without error as long as the first backup set file containing the root information is included as the first file or only file specified. If the "/OPTION=DEBUG" qualifier is used with the "RMU/DUMP/BACKUP" command, the backup command will be displayed along with the other summary record fields at the start of each backup set file.

The following example shows the new error messages for this case. The second backup set file created by the "RMU/BACKUP/DISK_FILE" command, "MFP01", is not specified by the "RMU/RESTORE" command.

```
$ RMU/RESTORE/NOLOG/NOCDD/DISK=READER=3 MFP,MFP02,MFP03
%RMU−I−AIJRSTAVL, 0 after−image journals available for use
%RMU−I−AIJISOFF, after−image journaling has been disabled
%RMU−W−USERECCOM, Use the RMU Recover command. The journals are not available.
%RMU−W−BCKCMDUSED, The backup command was
"RMU/BACKUP/NOLOG/DISK=WRITER=4 MF_PERSONNEL MFP,MFP01,MFP02,MFP03".
%RMU−E−RESINCOMP, Not all storage areas have been restored, the database may be
corrupt.
```

If, for the command "RMU/RESTORE/DISK_FILE/READER_THREADS=number", the number of reader threads specified was greater than the number of backup files specified, the following fatal message was put out and the restore was terminated. This message made sense only for tape backups where you can specify the "/VOLUMES" and "/MASTER" qualifiers.

```
%RMU−F−CONFLSWIT, conflicting qualifiers /VOLUMES and /MASTER
```

The %RMU−F−CONFLSWIT message has been replaced by the more general fatal error message below.

```
%RMU−F−EXTRAREADERS, "n", the number of reader threads, exceeds "n",
 the number of output files or master tape devices.
```

This message will not be displayed for the "RMU/DUMP/BACKUP" command which does not allow the number of reader threads to be specified.

The following example shows this last case. Five reader threads are specified for the "RMU/RESTORE/DISK_FILE" command but there are only four backup files in the backup file set so the first restore command fails. If four or fewer reader threads are specified, the command will succeed.

```
$ RMU/RESTORE/NOLOG/NOCDD/DISK=READER=5 MFP,MFP01,MFP02,MFP03
%RMU−F−EXTRAREADERS, "5", the number of reader threads, exceeds "4", the number
of output files or master tape devices.
%RMU−F−FTL_RSTR, Fatal error for RESTORE operation at 22−MAR−2011 10:17:08.23
$ RMU/RESTORE/NOLOG/NOCDD/DISK=READER=4 MFP,MFP01,MFP02,MFP03
%RMU−I−AIJRSTAVL, 0 after−image journals available for use
%RMU−I−AIJISOFF, after−image journaling has been disabled
%RMU−W−USERECCOM, Use the RMU Recover command. The journals are not available.
$ RMU/VERIFY/ALL MF_PERSONNEL
```

Chapter 14
Documentation Corrections, Additions and Changes

This chapter provides corrections for documentation errors and omissions.

14.1 Documentation Corrections

14.1.1 Oracle Rdb Release 7.2.x.x New Features Document Added

A new document has been created which contains all of the New Features Chapters from all previous Rdb 7.2 Release Notes. This document will be included in saveset A of the Rdb kit. It is called RDB_NEWFEATURES_72xx and will be available in postscript, text and PDF format. This will provide customers with one document to reference to find out about all new features that have been added to the Rdb 7.2 releases.

14.1.2 Oracle Rdb Position on NFS Devices

This release note describes the supported usage of the NFS (Network File System) mounted devices by the Oracle Rdb product. NFS devices appear in most regards as local mounted file systems but do not allow the same level of sharing as provided by local OpenVMS devices. In addition, these files reside on a non−OpenVMS system (for instance a Linux or Windows system) and are therefore outside any scheme used by Rdb to lock buffers and pages of the database.

Active System Files

When Rdb is actively using database files, these files require specific sharing and locking to guarantee database integrity and recovery. Therefore, because of the limitations of the NFS mounted devices, active files such as the database root (.rdb), storage areas (.rda), snapshot files (.snp), row cache work file (.rdc), after image journal files (.aij), and before image recovery journal (.ruj) must not reside on an NFS mounted device.

Archived Data Files

Files that are not part of the active system may be stored on NFS mounted devices. For example, RMU /BACKUP /AFTER_JOURNAL can be used to archive an after image journal to a target on an NFS device. Similarly, RMU /BACKUP can perform a full or incremental backup to an Rdb backup file (.rbf) on an NFS device and RMU /RESTORE can use that NFS mounted source for database recovery, along with archived after image files from an NFS device processed by RMU /RECOVER.

Other Miscellaneous Files

Other files that might be used by an Rdb installation include options files, application procedures and sources, backup journals, record definitions files (.rrd), unloaded database files (.unl), exported databases (.rbr), log files, and so on. These sequential files may be stored on and referenced by RMU and SQL commands from an NFS mounted device.

Setting Up NFS

Complete instructions for setting up an NFS mounted device is beyond the scope of this release note and customers are directed to use system specific documentation for the server platform and for HP OpenVMS systems. However, during testing with Oracle Rdb we noted the need for the following qualifiers for the TCPIP MOUNT command.

- Use /ADF=CREATE. This ensures that attributes (such as block size and record length) are preserved on the server.
- Use /STRUCTURE=5. This will emulate an ODS−5 device and therefore allow the most complete OpenVMS Files−11 On−Disk Structure emulation.
- Use /TRANSPORT=UDP. For example,

```
$ tcpip mount dnfs1:/host="test.company.com"/path="/scratch"
        /stru=5/serve=unix/adf/vers=2/tran=udp
```

Read Performance Issues

In versions of Oracle Rdb prior to Rdb V7.3.1.2, a significant performance issue exists when reading sequential files from NFS mounted devices. Oracle Rdb uses the RMS read−ahead (RAH) attribute to improve sequential reads but this has an adverse effect when referencing an NFS device. The latest release of Oracle Rdb (7.3.1.2, soon to be released) works around this issue by disabling the use of read−ahead when referencing an NFS device and would be the preferred version when using NFS devices.

Disclaimer

This information is provided to answer customer questions and should not be read as an endorsement or guarantee for NFS systems. Oracle expects configuration, functional testing, performance testing, security and integrity of the NFS data to be performed by our customers.

14.1.3 Missing Documentation for the TRANSACTION_TYPE Keyword for GET DIAGNOSTICS

Prior versions of the SQL Reference Manual omitted the description of the TRANSACTION_TYPE keyword for GET DIAGNOSTICS.

TRANSACTION_TYPE returns the type of transaction being executed. The result will be one of the following strings: 'BATCH UPDATE', 'READ ONLY', 'READ WRITE', or 'NONE'.

The result data type is CHAR (31).

Examples
Within a compound statement, you can use GET DIAGNOSTICS to retrieve information about the query state and its environment. In this example, we use the GET DIAGNOSTICS keywords TRANSACTION_TYPE and ROW_COUNT.

Example 14−1 Example: Using TRANSACTION_TYPE to control actions of a procedure

```
SQL> attach 'file MF_PERSONNEL';
SQL>
SQL> -- Sample procedure to use GET DIAGNOSTICS
SQL>
SQL> declare :rc integer;
SQL> declare :txn_type char(31);
SQL>
SQL> begin
cont>     set :rc = 0;
cont>     get diagnostics :txn_type = transaction_type;
cont>     trace '"' || :txn_type || '"';
```

```
cont>     case :txn_type
cont>         when 'BATCH UPDATE' then
cont>             begin
cont>             -- do nothing
cont>             end;
cont>         when 'READ ONLY' then
cont>             rollback;
cont>         when 'READ WRITE' then
cont>             delete from employees;
cont>             get diagnostics :rc = row_count;
cont>             trace 'Rows deleted = ', :rc;
cont>         when 'NONE' then
cont>             begin
cont>             -- no transaction so start one
cont>             set transaction read only;
cont>             end;
cont>     end case;
cont> end;
SQL>
SQL> print :txn_type, :rc;
 TXN_TYPE                                    RC
 NONE                                         0
SQL>
SQL> rollback;
```

14.1.4 Corrections to the EDIT STRING Documentation

Bugs 17365476 and 17365597

- The SQL Reference Manual, Volume 1, incorrectly stated that fields following a quoted literal would have leading zeros trimmed if the literal ended with a space. This was incorrect. The trimming only takes place after a space formatting character (B).
  This is the corrected text:
  Oracle Rdb automatically trims leading zeros from the first numeric field in the output, and any numeric field following a space formatting character (B). The year (Y) and fractional seconds (*) format fields are never trimmed of leading zeros.
- To have SQL represent an OpenVMS date format without removing the leading zero from the Hour field, use the literal string for space rather than the space formatting character (B).

  ```
  edit string 'YYYY-NN-DD" "RR:PP:QQ.**'
  ```

  rather than

  ```
  edit string 'YYYY-NN-DDBRR:PP:QQ.**'
  ```
- The formatting string ** represents the 100ths of a second field. Prior versions using a narrow field * would erroneously truncate the leading digits. This is corrected in this release, as the trailing digit is truncated.

14.1.5 RMU Replicate On−Line Help Reports Incorrect Maximum Checkpoint Value for Configure Qualifier

Bug 16546622

The on−line Help for the RMU/Replicate After_Journal Configure command qualifier Checkpoint shows an incorrect maximum value for the checkpoint−interval. It shows the following:

```
Maximum Value:     1024 messages
```

The actual maximum value accepted for the checkpoint−interval is 50000.

This has been corrected in the on−line Help in Oracle Rdb Release 7.2.5.3.

14.1.6 Missing or Incorrect Documentation for SET AUTOMATIC TRANSLATION Command

Bug 14354801

The following errors or omissions occur in the SQL Reference Manual, Volume 4, for the SET AUTOMATIC TRANSLATION statement.

- The syntax diagram does not indicate that the *runtime−options* is optional.
- If the *runtime−options* is omitted, the default behavior is to assume 'ON' as the parameter and enable automatic translation.
- The syntax diagram does not document the Interactive SQL statements; SET NOAUTOMATIC TRANSLATION, or the alternate SET NO AUTOMATIC TRANSLATION statement.
- The arguments section asserts that DEFAULT is a legal keyword, or value for the parameter. This is incorrect; only ON or OFF are legal for the *runtime−options*.
- The following usage notes should be present.
    - The SET NOAUTOMATIC TRANSLATION and SET NO AUTOMATIC TRANSLATION statements may only be used in Interactive SQL. They are equivalent to SET AUTOMATIC TRANSLATION OFF.
    - If AUTOMATIC TRANSLATION is enabled, then translation is attempted between different versions of the table rows. For instance, after an ALTER TABLE command, where a new character set is specified for existing data. This is demonstrated in the following example.

```
SQL> create table SAMPLE (description char(20));
SQL> insert into SAMPLE (description) values ('Sample text');
1 row inserted
SQL> select description from SAMPLE;
 DESCRIPTION
 Sample text
1 row selected
SQL> alter table SAMPLE modify (description char(20) character set utf8);
SQL> select description from SAMPLE;
%RDB-E-CONVERT_ERROR, invalid or unsupported data conversion
-RDMS-E-CSETBADASSIGN, incompatible character sets prohibit the requested
assignment
SQL> set automatic translation;
SQL> select description from SAMPLE;
 DESCRIPTION
 Sample text
1 row selected
SQL>
```

Note that once the restructuring from an old version is created in the current session, it is not undone by disabling AUTOMATIC TRANSLATION.

The following examples show the usage of this statement.

Example 1: Using SET AUTOMATIC TRANSLATION command from a SQL Module Language procedure

```
procedure SET_AUTO_TRANS (sqlcode);
    SET AUTOMATIC TRANSLATION ON;
```

Or if a parameter is passed:

```
procedure SET_AUTO_TRANS
    (sqlcode,
    :on_off char(3)
    );
    SET AUTOMATIC TRANSLATION :on_off;
```

Example 2: Using SET AUTOMATIC TRANSLATION at runtime

```
SQL> declare :auto_trans char(10);
SQL> accept :auto_trans;
Enter value for AUTO_TRANS: off
SQL> set automatic translation :auto_trans;
SQL> show automatic translation;
Automatic translation: OFF
SQL>
```

14.1.7 Clarification on Using the RMU/UNLOAD TRIM=TRAILING Option

The following example shows that unexpected results may occur with the RMU/UNLOAD command Trim option when spaces are unloaded from an Oracle Rdb database.

Create a table in an Rdb database with two character columns and insert spaces and other character data into the table fields.

```
SQL> create database filename testdb;
create table tab1(col1 char(2), col2 char(2));
insert into tab1 values ('  ', '  ');
insert into tab1 values ('AB', '  ');
insert into tab1 values ('  ', 'CD');
insert into tab1 values ('A ', 'C ');
commit;
```

Unload the character field data from the table, specifying the Trim=trailing option to eliminate trailing spaces but do not specify prefix or suffix delimiter values.

```
 $ rmu/unload/record=(file=tab1, –
   format=delimited_text, prefix="", suffix="", separator="|", –
   null="NULL", trim=trailing) testdb tab1 tab1
```

The trailing spaces are eliminated from the unload file since the Trim=trailing option was used.

```
$ ty tab1.unl
|
AB|
|CD
A|C
```

Now load the unloaded data back into the database table from the unload file.

```
$ rmu/load/log/record=(file=tab1, –
   format=delimited_text, prefix="", suffix="", separator="|", –
   null="NULL") testdb tab1 tab1
```

This is the result:

```
SQL> att 'f testdb';
SQL> select '>' || col1 || '<   ','>' || col2 || '<' from tab1;

 >  <      >  <
 >AB<      >  <
 >  <      >CD<
 >A <      >C <
 >  <      NULL
 >AB<      NULL
 >  <      >CD<
 >A <      >C <
8 rows selected
```

The first and second row, which originally contained two spaces in COL2, are now set to NULL. This happens because of the use of the option Trim=trailing in the RMU/UNLOAD command.

Because neither prefix nor suffix characters are specified in the RMU/UNLOAD command, it cannot be determined whether values existed in the character fields which only contained spaces or if these fields were flagged as NULL fields in the database.

The trailing column is set to NULL as described by the Oracle Rdb RMU Reference Manual which states:

"If the final column or columns of a record are to be set to NULL, you only have to specify data for the column up to the last non−null column. See the Examples section for an example of each of these methods of storing the NULL value."

Therefore, a trailing empty field will be null. Inner columns will be null if set to the string specified by the NULL option.

To avoid this result, you could eliminate the TRIM option in the RMU/UNLOAD command, or if you need the TRIM option then you can avoid this result by specifying a character value for the PREFIX and SUFFIX separator options for both the RMU/LOAD and the RMU/UNLOAD commands as in the following example.

```
$ rmu/unload/record=(file=tab1, –
   format=delimited_text, prefix="*", suffix="*", separator="|", –
   null="NULL", trim=trailing) testdb tab1 tab1
$
$ ty tab1.unl
**|**
*AB*|**
```

```
**|*CD*
*A*|*C*
$
$ rmu/load/log/record=(file=tab1, –
   format=delimited_text, prefix="*", suffix="*", separator="|", –
   null="NULL") testdb tab1 tab1
```

14.1.8 Required Privileges for AUTHORIZATION Clause of CREATE MODULE

The following usage note is missing from the SQL Reference Manual, under the CREATE MODULE Statement.

- When the AUTHORIZATION clause is used, the definer of the module is granting their own privileges to the specified username so that tables, columns, sequences, procedures and functions are accessed as though accessed by the definer.
  The AUTHORIZATION is expected to be the session user, or an OpenVMS rights identifier granted to that user (when SECURITY CHECKING IS EXTERNAL). If the session is run with one of the following OpenVMS privileges, then any user or rights identifier can be referenced: SYSPRV, BYPASS or IMPERSONATE.

Note

The OpenVMS IMPERSONATE privilege can be used to override the checking for Oracle Rdb Release 7.2.5.1 and later versions.

14.1.9 ROUND and TRUNC Are Built In Functions for SQL

The functions ROUND and TRUNC for numeric values are now supported as native functions in Oracle Rdb.

Fixed point values are now truncated and rounded correctly. Floating values, while supported by ROUND and TRUNC, may not always return the expected results. Please review usage of ROUND in such contexts.

The result type for ROUND and TRUNC will match the data type of the input source parameter.

Usage Notes

- The implementation of ROUND and TRUNC for DATE values requires the use of the OCI Services for Rdb library (also know as SQL*net for Rdb). These functions will now accept DATE ANSI, TIMESTAMP and DATE VMS values.
  Attempts to use ROUND or TRUNC on a database that is not setup for OCI Services will receive errors similar to these:

```
SQL> select TRUNC (current_date) from rdb$database;
%RDB-E-OBSOLETE_METADA, request references metadata objects that no longer exist
-RDMS-F-BAD_SYM, unknown routine symbol - TRUN2
SQL> select ROUND (current_date) from rdb$database;
%RDB-E-OBSOLETE_METADA, request references metadata objects that no longer exist
-RDMS-F-BAD_SYM, unknown routine symbol - ROUN2
```

Note

The special functions ROUN2 and TRUN2 are internal routines to deal with DATE types.

- Both ROUND and TRUNC support the data types REAL, FLOAT and DOUBLE PRECISION for both parameter and results. However, due to the imprecise nature of floating point arithmetic, this may cause unexpected results. A value such as 4.185 will not round to 4.19 as expected because the internal (and approximate) representation of the number is something like 4.184999942780E+000 and therefore does not appear to require rounding to the second decimal place according to the rounding rules.
  The following example shows this problem.

```
SQL> select cast(round (4.185,2) as integer(2)) from rdb$database;

          4.18
1 row selected
SQL> select cast(round (4.175,2) as integer(2)) from rdb$database;

          4.18
1 row selected
SQL>
```

Note

The result of a divide operation (/) or the AVG, STDDEV, VARIANCE statistical functions are floating point values so applying TRUNC or ROUND to those results, even if performed on integer sources, will also be affected by the intermediate floating point type.

- If you use SQL to access older versions of Rdb (such as via remote access) then SQL will revert to the previous behavior and use the SQL functions provided by the SQL_FUNCTIONS library.

14.1.10 Missing Documentation for CREATE OUTLINE Statement

Bug 9864420

Prior releases of the Oracle Rdb documentation omitted a description of query outlines pertaining to views.

When Rdb compiles a query that references a view, it will implicitly use the view name to locate a matching query outline. This allows the database administrator to create partial query outlines that tune just that part of the query involving the view.

However, if the query outline is named with the same name as a view but does not follow the structure of the view then a RDMS−F−LEVEL_MISMATCH error will be reported.

The following example shows this problem.

```
SQL> create outline CURRENT_JOB
cont>   from (select * from CURRENT_JOB limit to 1 rows);
SQL>
SQL> show outline CURRENT_JOB;
     CURRENT_JOB
 Source:

-- Rdb Generated Outline :  2-SEP-2010 10:24
create outline CURRENT_JOB
id 'E9968EFAF723ED23DF59216A5DDE4C7D'
mode 0
as (
  query (
-- For loop
    subquery (
      subquery (
        EMPLOYEES 1     access path index       EMP_EMPLOYEE_ID
          join by match to
        JOB_HISTORY 0   access path index       JH_EMPLOYEE_ID
        )
      )
    )
  )
compliance optional     ;
SQL>
SQL> set flags 'strategy,detail(2)';
SQL>
SQL> select * from CURRENT_JOB limit to 1 rows;
~S: Outline "CURRENT_JOB" used
%RDMS-F-LEVEL_MISMATCH, the table/subquery nesting levels
in the query outline do not match the query
SQL>
```

To resolve this problem, the database administrator must change the name of the outline so that it is not assumed to describe the view record selection definition.

```
SQL> create outline CURRENT_JOB_REF
cont>   from (select * from CURRENT_JOB limit to 1 rows);
SQL>
SQL> set flags 'strategy,detail(2)';
SQL>
SQL> select * from CURRENT_JOB limit to 1 rows;
~S: Outline "CURRENT_JOB_REF" used
...
 LAST_NAME        FIRST_NAME   EMPLOYEE_ID   JOB_CODE   DEPARTMENT_CODE
SUPERVISOR_ID   JOB_START
 Toliver          Alvin        00164         DMGR       MBMN
00228           21-Sep-1981
1 row selected
SQL>
SQL> select * from CURRENT_JOB where employee_id = '00164'
cont> optimize using CURRENT_JOB_REF;
~S: Outline "CURRENT_JOB_REF" used
...
 LAST_NAME        FIRST_NAME   EMPLOYEE_ID   JOB_CODE   DEPARTMENT_CODE
SUPERVISOR_ID   JOB_START
 Toliver          Alvin        00164         DMGR       MBMN
00228           21-Sep-1981
1 row selected
SQL>
```

Alternatively, create the query outline on the view itself to allow it to be used more widely.

```
SQL> create outline CURRENT_JOB
cont>   on view CURRENT_JOB;
SQL>
SQL> show outline CURRENT_JOB;
     CURRENT_JOB
 Source:

-- Rdb Generated Outline :  2-SEP-2010 10:52
create outline CURRENT_JOB
-- On view CURRENT_JOB
id '9C6D98DAAF09A3E1796F7D345399028B'
mode 0
as (
  query (
-- View
    subquery (
      EMPLOYEES 1     access path index       EMP_EMPLOYEE_ID
        join by match to
      JOB_HISTORY 0   access path index       JH_EMPLOYEE_ID
      )
    )
  )
compliance optional     ;
SQL>
SQL> set flags 'strategy,detail(2)';
SQL>
SQL> select * from CURRENT_JOB limit to 1 rows;
~S: Outline "CURRENT_JOB" used
...
SQL>
```

14.1.11 Sorting Capabilities in Oracle Rdb

Oracle Rdb supports both the traditional OpenVMS SORT32 facility as well as a simplified internal sort facility called QSORT.

QSORT

Use of QSORT preempts use of all other sorting algorithms. The QSORT algorithm is used if sorting is being done on a single key and if only a small amount of data is involved. The reason for this is that the other sorting algorithms, while using more efficient methods, have a certain amount of overhead associated with setting them up and with being general purpose routines.

QSORT is used by default if:

- There is a single sort key.
- The number of rows to be sorted is 5000 or fewer.
- The sort key is not floating point (REAL, FLOAT, or DOUBLE PRECISION).

How to Alter QSORT Usage

To change the usage of QSORT to evaluate behavior with other parameters, define a new row limit as follows:

```
$ DEFINE RDMS$BIND_MAX_QSORT_COUNT m
```

The default value is 5000 rows.

Note

Defining the logical RDMS$BIND_MAX_QSORT_COUNT as 63 will return QSORT behavior to that used by prior releases of Oracle Rdb V7.2.

To disable QSORT because of either anomalous or undesirable performance, the user can define the following logical to the value zero, in which case the VMS SORT interface is always used.

```
$ DEFINE RDMS$BIND_MAX_QSORT_COUNT 0
```

14.1.12 RMU /SET ROW_CACHE Command Updates

The documentation and online help for the "RMU /SET ROW_CACHE" command inadvertantly did not include the full set of allowed keywords and qualifiers.

The valid command line qualifiers for the "RMU /SET ROW_CACHE" command are:

- Alter − Specifies the action to take on the named cache. You must specify the cache name and at least one other option.
- Disable − Disables row caching. Do not use with the Enable qualifier.
- Enable − Enables row caching. Do not use with the Disable qualifier.
- Log − Specifies whether the processing of the command is reported to SYS$OUTPUT. Specify the Log qualifier to request log output and the Nolog qualifier to prevent it. If you specify neither, the default is the current setting of the DCL verify switch.
- Backing_Store_Location=devdir − Specify the per−database default backing store location.
- NoBacking_Store_Location − Remove the per−database default backing store location and revert back to the default backing store file location of the root file device and directory.

The valid values for the ALTER qualifier are:

- NAME=cachename − Name of the cache to be modified. The cache must already be defined in the database. This is a required parameter. This parameter accepts the wildcard characters asterisk (*) and percent sign (%).
- ENABLE − Enable the cache.
- DISABLE − Disable the cache.
- DROP − Drop (delete) the cache.
- SNAPSHOT_SLOT_COUNT=n − Specify the number of snaphot slots in the cache. A value of zero disables the snapshot portion for the specified cache.
- SLOT_COUNT=n − Specify the number of slots in the cache.
- SLOT_SIZE=n − Specify the size (in bytes) of each slot in the cache.
- WORKING_SET_COUNT=n − Specify the number of working set entries for the cache. Valid values are from 1 to 100.
- BACKING_STORE_LOCATION=devdir − Specify the per−cache default backing store location.
- NOBACKING_STORE_LOCATION − Remove the per−cache default backing store location and revert back to the database default backing store file location.

- SHARED_MEMORY − Specify the shared memory type and parameters for the cache. Valid keywords are:
  - TYPE=PROCESS to specify traditional shared memory global section, which means that the database global section is located in process (P0) address space and may be paged from the processes working set as needed.
  - TYPE=RESIDENT to specify that the database global section is memory resident in process (P0) address space using OpenVMS Alpha shared page tables, which means that a system space global section is fully resident, or pinned, in memory.
  - RAD_HINT= "number" to indicate a request that memory for this shared memory should be allocated from the specified OpenVMS Alpha Resource Affinity Domain (RAD). This parameter specifies a hint to Oracle Rdb and OpenVMS about where memory should be physically allocated. It is possible that if the memory is not available, it will be allocated from other RADs in the system. For systems that do not support RADs, no RAD_HINT specification is valid.
    The RAD_HINT qualifier is only valid when the shared memory type is set to RESIDENT. Setting the shared memory type to SYSTEM or PROCESS explicitly disables any previously defined RAD hint.

    Note

    OpenVMS support for RADs is available only on the AlphaServer GS series systems. For more information about using RADs, refer to the OpenVMS Alpha Partitioning and Galaxy Guide.
  - NORAD_HINT disables the RAD hint.

The "/ALTER=(...)" qualifier may be specified multiple times on the command line. Each /ALTER qualifier specified operates on one unique cache if no wildcard character (% or *) is specified. Otherwise, Each /ALTER operates on all matching cache names.

For example, the following command alters two caches:

```
$ RMU /SET ROW_CACHE MF_PERSONNEL −
        /ALTER= (   NAME = RDB$SYS_CACHE,
                    SLOT_COUNT = 800) −
        /ALTER= (   NAME = RESUMES, −
                    SLOT_SIZE=500, −
                    WORKING_SET_COUNT = 15)
```

The following command alters caches named FOOD and FOOT (and any other cache with a 4 character name with the first three characters of "FOO" defined in the database):

```
$ RMU /SET ROW_CACHE MF_PERSONNEL −
        /ALTER= (   NAME = FOO%,
                    BACKING_STORE_LOCATION=DISK$RDC:[RDC])
```

14.1.13 Documentation for the DEBUG_OPTIONS Qualifier of RMU Unload

Bug 8447357

The RMU Help file and RMU Reference Manual is missing the description of the following qualifier for RMU Unload.

The DEBUG_OPTIONS qualifier accepts a list of keyword options.

- [NO]TRACE
  Traces the qualifier and parameter processing performed by RMU Unload. In addition, the query executed to read the table data is annotated with the TRACE statement at each Commit (controlled by Commit_Every qualifier). When the logical name RDMS$SET_FLAGS is defined as "TRACE", then a line similar to the following is output after each commit is performed.

  ```
  ~Xt: 2009-04-23 15:16:16.95: Commit executed.
  ```

  The default is NOTRACE.

  ```
  $ RMU/UNLOAD/REC=(FILE=WS,FORMAT=CONTROL) SQL$DATABASE WORK_STATUS WS/DEBUG=
  TRACE
  Debug = TRACE
  * Synonyms are not enabled
  Row_Count = 500
  Message buffer: Len: 13524
  Message buffer: Sze: 27, Cnt: 500, Use: 4 Flg: 00000000
  %RMU-I-DATRECUNL,   3 data records unloaded.
  ```
- [NO]FILENAME_ONLY
  When the qualifier Record_Definition=Format:CONTROL is used, the name of the created unload file is written to the control file (.CTL). When the keyword FILENAME_ONLY is specified, RMU Unload will prune the output file specification to show only the file name and type. The default is NOFILENAME_ONLY.

  ```
  $ RMU/UNLOAD/REC=(FILE=TT:,FORMAT=CONTROL) SQL$DATABASE WORK_STATUS WS/DEBUG=
  FILENAME
  --
  -- SQL*Loader Control File
  --   Generated by: RMU/UNLOAD
  --   Version:      Oracle Rdb X7.2-00
  --   On:           23-APR-2009 11:12:46.29
  --
  LOAD DATA
  INFILE 'WS.UNL'
  APPEND
  INTO TABLE "WORK_STATUS"
  (
   STATUS_CODE                    POSITION(1:1) CHAR NULLIF (RDB$UL_NB1 = '1')
  ,STATUS_NAME                    POSITION(2:9) CHAR NULLIF (RDB$UL_NB2 = '1')
  ,STATUS_TYPE                    POSITION(10:23) CHAR NULLIF (RDB$UL_NB3 = '1')
  -- NULL indicators
  ,RDB$UL_NB1           FILLER POSITION(24:24) CHAR -- indicator for STATUS_CODE
  ,RDB$UL_NB2           FILLER POSITION(25:25) CHAR -- indicator for STATUS_NAME
  ,RDB$UL_NB3           FILLER POSITION(26:26) CHAR -- indicator for STATUS_TYPE
  )
  %RMU-I-DATRECUNL,   3 data records unloaded.
  ```
- [NO]HEADER
  This keyword controls the output of the header in the control file. To suppress the header, use NOHEADER. The default is HEADER.
- APPEND, INSERT, REPLACE, TRUNCATE

These keywords control the text that is output prior to the INTO TABLE clause in the control file. The default is APPEND and only one of these options can be specified.

14.1.14 SQL$MSGxx.DOC Is Not Alphabetical

Bug 4387383

The last paragraph of page A−3 of volume 5 of the SQL Reference Manual says the message codes in files such as SQL$MSG71.DOC are alphabetized. However, it was found that the message codes were not alphabetized in SQL$MSG71.DOC or SQL$MSG72.DOC.

The cause of this problem was that the COSI message codes were appended to the end of the SQL message codes in this file.

This has been corrected in Oracle Rdb Release 7.2.4. We no longer append the COSI message codes to the SQL$MSGnn.DOC file since the COSI message codes are available separately.

14.1.15 LOCK_TIMEOUT Documentation Error in RMU Reference Manual Release 7.2

The "Oracle Rdb for OpenVMS: Oracle RMU Reference Manual Release 7.2" incorrectly implies that there is a default value for the lock timeout in seconds specified by the /LOCK_TIMEOUT qualifier in the following sections:

- 1.10 RMU/BACKUP COMMAND
- 1.11 RMU/BACKUP/AFTER_JOURNAL COMMAND
- 1.17 RMU COPY_DATABASE COMMAND

In all these sections, in the description of the "/Lock_Timeout=n" qualifier, any reference to a default value such as "The default value for the /Lock_Timeout=n qualifier is ..." needs to be removed since there is no default value allowed for this qualifier. If you specify the /LOCK_TIMEOUT qualifier, you have to specify the lock timeout value in seconds. If you do not specify the /LOCK_TIMEOUT qualifier, the default is to wait indefinitely to acquire the QUIET POINT lock and any other locks needed for ONLINE execution of the command. It should also be mentioned that the LOCK_TIMEOUT value does not only affect the QUIET POINT lock but can affect other locks RMU may need to acquire for ONLINE execution.

14.1.16 Revised Example for SET OPTIMIZATION LEVEL Statement

Bug 6350960

Example 1: Setting the optimization level

The dynamic optimizer can use either FAST FIRST or TOTAL TIME tactics to return rows to the application. The default setting, FAST FIRST, assumes that applications, especially those using interactive SQL, will want to see rows as quickly as possible and possibly abort the query before completion. Therefore, if the FAST FIRST tactic is possible, the optimizer will sacrifice overall retrieval time to initially return rows quickly. This

choice can be affected by setting the OPTIMIZATION LEVEL.

The following example contrasts the query strategies selected when FAST FIRST versus TOTAL TIME is in effect. Databases and queries will vary in their requirements. Queries should be tuned to see which setting best suits the needs of the application environment. For the MF_PERSONNEL database, there is little or no difference between these tactics but for larger tables the differences could be noticeable.

```
SQL> set flags 'STRATEGY,DETAIL';
SQL> --
SQL> -- No optimization level has been selected. The optimizer
SQL> -- selects the FAST FIRST (FFirst) retrieval tactic to
SQL> -- retrieve the rows from the EMPLOYEES table in the
SQL> -- following query:
SQL> --
SQL> select EMPLOYEE_ID, LAST_NAME
cont> from EMPLOYEES
cont> where EMPLOYEE_ID IN ('00167', '00168');
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: (0.EMPLOYEE_ID = '00167') OR (0.EMPLOYEE_ID = '00168')
  BgrNdx1 EMPLOYEES_HASH [(1:1)2] Fan=1
    Keys: r0: 0.EMPLOYEE_ID = '00168'
          r1: 0.EMPLOYEE_ID = '00167'
 EMPLOYEE_ID   LAST_NAME
 00167         Kilpatrick
 00168         Nash
2 rows selected
SQL> --
SQL> -- Use the SET OPTIMIZATION LEVEL statement to specify that
SQL> -- you want the TOTAL TIME (BgrOnly) retrieval strategy to
SQL> -- be used.
SQL> --
SQL> SET OPTIMIZATION LEVEL 'TOTAL TIME';
SQL> select EMPLOYEE_ID, LAST_NAME
cont> from EMPLOYEES
cont> where EMPLOYEE_ID IN ('00167', '00168');
Tables:
  0 = EMPLOYEES
Leaf#01 BgrOnly 0:EMPLOYEES Card=100
  Bool: (0.EMPLOYEE_ID = '00167') OR (0.EMPLOYEE_ID = '00168')
  BgrNdx1 EMPLOYEES_HASH [(1:1)2] Fan=1
    Keys: r0: 0.EMPLOYEE_ID = '00168'
          r1: 0.EMPLOYEE_ID = '00167'
 EMPLOYEE_ID   LAST_NAME
 00167         Kilpatrick
 00168         Nash
2 rows selected
SQL> --
SQL> -- When the SET OPTIMIZATION LEVEL 'DEFAULT' statement
SQL> -- is specified the session will revert to the default FAST FIRST
SQL> -- optimizer tactic.
SQL> --
SQL> SET OPTIMIZATION LEVEL 'DEFAULT';
SQL> select EMPLOYEE_ID, LAST_NAME
cont> from EMPLOYEES
cont> where EMPLOYEE_ID IN ('00167', '00168');
Tables:
  0 = EMPLOYEES
Leaf#01 FFirst 0:EMPLOYEES Card=100
  Bool: (0.EMPLOYEE_ID = '00167') OR (0.EMPLOYEE_ID = '00168')
```

```
  BgrNdx1 EMPLOYEES_HASH [(1:1)2] Fan=1
    Keys: r0: 0.EMPLOYEE_ID = '00168'
          r1: 0.EMPLOYEE_ID = '00167'
 EMPLOYEE_ID   LAST_NAME
 00167         Kilpatrick
 00168         Nash
2 rows selected
SQL>
```

14.1.17 RMU /VERIFY Process Quotas and Limits Clarification

When using the RMU/VERIFY command, a process requires a minimum of the following quotas:

- FILLM and CHANNELCNT at least 25 more than the total number of database storage areas, snapshot storage areas, and after image journals.
- Large enough BYTLM, page file quota and working set to open all of the database storage areas, snapshot storage areas, and after image journals.

14.1.18 Online Backup Can Be Performed With Transfer Via Memory

The following incorrect Oracle RMU BACKUP command restriction will be removed from the Oracle RMU Reference Manual.

In prior releases of the Oracle RMU Reference Manual, it states under the RMU Backup Online option that "However, an online backup operation cannot be performed if TRANSFER VIA MEMORY, also referred to as optimized page transfer, is enabled. (See the description of the SQL ALTER DATABASE statement in the Oracle Rdb SQL Reference Manual for information on optimized page transfer.)". This restriction is no longer true and will be removed from the Oracle RMU Reference Manual.

The same restriction is also listed for the Online Copy Database and for the Online Move Area commands. This restriction is no longer in place for these commands so it will be removed from the Oracle RMU Reference Manual.

14.1.19 Missing Example for CREATE STORAGE MAP

Bug 5655348

The SQL Reference Manual did not include an example showing the storage area attributes for a LIST storage map. The following example will appear in a future version of the Oracle Rdb V7.2 SQL Reference Manual in the CREATE STORAGE MAP section.

Example

The following example shows the use of storage area attributes in a LIST storage map. The storage area attributes must be immediately following the storage area name (as in table storage maps).

```
SQL> create database
cont>     filename 'DB$:MULTIMEDIA'
cont>
cont>     create storage area PHOTO_AREA1
cont>         filename 'DB$:PHOTO_AREA1'
cont>         page format UNIFORM
cont>
cont>     create storage area PHOTO_AREA2
cont>         filename 'DB$:PHOTO_AREA2'
cont>         page format UNIFORM
cont>
cont>     create storage area TEXT_AREA
cont>         filename 'DB$:TEXT_AREA'
cont>         page format UNIFORM
cont>
cont>     create storage area AUDIO_AREA
cont>         filename 'DB$:AUDIO_AREA'
cont>         page format UNIFORM
cont>
cont>     create storage area DATA_AREA
cont>         filename 'DB$:DATA_AREA'
cont>         page format UNIFORM
cont> ;
SQL>
SQL> create table EMPLOYEES
cont>     (name       char(30),
cont>      dob        date,
cont>      ident      integer,
cont>      photograph list of byte varying (4096) as binary,
cont>      resume     list of byte varying (132) as text,
cont>      review     list of byte varying (80) as text,
cont>      voiceprint list of byte varying (4096) as binary
cont>     );
SQL>
SQL> create storage map EMPLOYEES_MAP
cont>     for EMPLOYEES
cont>     enable compression
cont>     store in DATA_AREA;f
SQL>
SQL> create storage map LISTS_MAP
cont>     store lists
cont>         in AUDIO_AREA
cont>                 (thresholds are (89, 99, 100)
cont>                 ,comment is 'The voice clips'
cont>                 ,partition AUDIO_STUFF)
cont>             for (employees.voiceprint)
cont>         in TEXT_AREA
cont>                 (thresholds is (99)
cont>                 ,partition TEXT_DOCUMENTS)
cont>             for (employees.resume, employees.review)
cont>         in (PHOTO_AREA1
cont>                 (comment is 'Happy Smiling Faces?'
cont>                 ,threshold is (99)
cont>                 ,partition PHOTOGRAPHIC_IMAGES_1)
cont>             ,PHOTO_AREA2
cont>                 (comment is 'Happy Smiling Faces?'
cont>                 ,threshold is (99)
cont>                 ,partition PHOTOGRAPHIC_IMAGES_2)
cont>             )
cont>             for (employees.photograph)
cont>             fill randomly
cont>         in RDB$SYSTEM
```

```
cont>                (partition SYSTEM_LARGE_OBJECTS);
SQL>
SQL> show storage map LISTS_MAP;
     LISTS_MAP
 For Lists
 Store clause:          STORE lists
        in AUDIO_AREA
                (thresholds are (89, 99, 100)
                ,comment is 'The voice clips'
                ,partition AUDIO_STUFF)
            for (employees.voiceprint)
        in TEXT_AREA
                (thresholds is (99)
                ,partition TEXT_DOCUMENTS)
            for (employees.resume, employees.review)
        in (PHOTO_AREA1
                (comment is 'Happy Smiling Faces?'
                ,threshold is (99)
                ,partition PHOTOGRAPHIC_IMAGES_1)
            ,PHOTO_AREA2
                (comment is 'Happy Smiling Faces?'
                ,threshold is (99)
                ,partition PHOTOGRAPHIC_IMAGES_2)
            )
            for (employees.photograph)
            fill randomly
        in RDB$SYSTEM
                (partition SYSTEM_LARGE_OBJECTS)

 Partition information for lists map:
 Vertical Partition: VRP_P000
  Partition: (1) AUDIO_STUFF
    Fill Randomly
   Storage Area: AUDIO_AREA
         Thresholds are (89, 99, 100)
 Comment:       The voice clips
  Partition: (2) TEXT_DOCUMENTS
    Fill Randomly
   Storage Area: TEXT_AREA
         Thresholds are (99, 100, 100)
  Partition: (3) PHOTOGRAPHIC_IMAGES_1
    Fill Randomly
   Storage Area: PHOTO_AREA1
         Thresholds are (99, 100, 100)
 Comment:       Happy Smiling Faces?
  Partition: (3) PHOTOGRAPHIC_IMAGES_2
   Storage Area: PHOTO_AREA2
         Thresholds are (99, 100, 100)
 Comment:       Happy Smiling Faces?
  Partition: (4) SYSTEM_LARGE_OBJECTS
    Fill Randomly
   Storage Area: RDB$SYSTEM
SQL>
SQL> commit;
```

14.1.20 RDM$BIND_MAX_DBR_COUNT Documentation Clarification

Bugs 1495227 and 3916606

The Rdb7 Guide to Database Performance and Tuning Manual, Volume 2, page A−18, incorrectly describes the use of the RDM$BIND_MAX_DBR_COUNT logical.

Following is an updated description. Note that the difference in actual behavior between what is in the existing documentation and software is that the logical name only controls the number of database recovery processes created at once during "node failure" recovery (that is, after a system or monitor crash or other abnormal shutdown) for each database.

When an entire database is abnormally shut down (due, for example, to a system failure), the database will have to be recovered in a "node failure" recovery mode. This recovery will be performed by another monitor in the cluster if the database is opened on another node or will be performed the next time the database is opened.

The RDM$BIND_MAX_DBR_COUNT logical name and the RDB_BIND_MAX_DBR_COUNT configuration parameter define the maximum number of database recovery (DBR) processes to be simultaneously invoked by the database monitor for each database during a "node failure" recovery.

This logical name and configuration parameter apply only to databases that do not have global buffers enabled. Databases that utilize global buffers have only one recovery process started at a time during a "node failure" recovery.

In a node failure recovery situation with the Row Cache feature enabled (regardless of the global buffer state), the database monitor will start a single database recovery (DBR) process to recover the Row Cache Server (RCS) process and all user processes from the oldest active checkpoint in the database.

Per−Database Value

The RDM$BIND_MAX_DBR_COUNT logical name specifies the maximum number of database recovery processes to run at once for each database. For example, if there are 10 databases being recovered and the value for the RDM$BIND_MAX_DBR_COUNT logical name is 8, up to 80 database recovery processes would be started by the monitor after a node failure.

The RDM$BIND_MAX_DBR_COUNT logical name is translated when the monitor process opens a database. Databases need to be closed and reopened for a new value of the logical to become effective.

14.1.21 Database Server Process Priority Clarification

By default, the database servers (ABS, ALS, DBR, LCS, LRS, RCS) created by the Rdb monitor inherit their VMS process scheduling base priority from the Rdb monitor process. The default priority for the Rdb monitor process is 15.

Individual server priorities can be explicitly controlled via system−wide logical names as described in Table 14−1.

Table 14−1 Server Process Priority Logical Names

Logical Name	Use
RDM$BIND_ABS_PRIORITY	Base Priority for the ABS Server process
RDM$BIND_ALS_PRIORITY	Base Priority for the ALS Server process
RDM$BIND_DBR_PRIORITY	Base Priority for the DBR Server process
RDM$BIND_LCS_PRIORITY	Base Priority for the LCS Server process
RDM$BIND_LRS_PRIORITY	Base Priority for the LRS Server process
RDM$BIND_RCS_PRIORITY	Base Priority for the RCS Server process

When the Hot Standby feature is installed, the RDMAIJSERVER account is created specifying an account priority of 15. The priority of AIJ server processes on your system can be restricted with the system−wide logical name RDM$BIND_AIJSRV_PRIORITY. If this logical name is defined to a value less than 15, an AIJ server process will adjust its base priority to the value specified when the AIJ server process starts. Values from 0 to 31 are allowed for RDM$BIND_AIJSRV_PRIORITY, but the process is not able to raise its priority above the RDMAIJSERVER account value.

For most applications and systems, Oracle discourages changing the server process priorities.

14.1.22 Explanation of SQL$INT in a SQL Multiversion Environment and How to Redefine SQL$INT

Bug 2500594

In an environment running multiple versions of Oracle Rdb, for instance Rdb V7.0 and Rdb V7.1, there are now several varianted SQL images, such as SQL$70.EXE and SQL$71.EXE. However, SQL$INT.EXE is not varianted but acts as a dispatcher using the translation of the logical name RDMS$VERSION_VARIANT to activate the correct SQL runtime environment. This image is replaced when a higher version of Oracle Rdb is installed. Thus, using the example above, when Rdb V7.1 is installed, SQL$INT.EXE will be replaced with the V7.1 SQL$INT.EXE.

If an application is linked in this environment (using V7.1 SQL$INT) and the corresponding executable deployed to a system running Oracle Rdb V7.0 multiversion only, the execution of the application may result in the following error:

```
%IMGACT−F−SYMVECMIS, shareable image's symbol vector table mismatch
```

In order to avoid such a problem, the following alternative is suggested:

In the multiversion environment running both Oracle Rdb V7.0 and Oracle Rdb V7.1, run Oracle Rdb V7.0 multiversion by running the command procedures RDB$SETVER.COM 70 and RDB$SETVER RESET. This will set up the necessary logical names and symbols that establish the Oracle Rdb V7.0 environment.

For example:

```
$ @SYS$LIBRARY:RDB$SETVER 70

Current PROCESS Oracle Rdb environment is version V7.0−63 (MULTIVERSION)
Current PROCESS SQL environment is version V7.0−63 (MULTIVERSION)
Current PROCESS Rdb/Dispatch environment is version V7.0−63 (MULTIVERSION)
```

```
$ @SYS$LIBRARY:RDB$SERVER RESET
```

Now run SQL and verify that the version is correct:

```
$ sql$
SQL> show version
Current version of SQL is: Oracle Rdb SQL V7.0−63
```

Define SQL$INT to point to the varianted SQL$SHR.EXE. Then, create an options file directing the linker to link with this newly defined SQL$INT. An example follows:

```
$ DEFINE SQL$INT SYS$SHARE:SQL$SHR'RDMS$VERSION_VARIANT'.EXE
$ LINK TEST_APPL,SQL$USER/LIB,SYS$INPUT/option
SQL$INT/SHARE
^Z
```

The executable is now ready to be deployed to the Oracle Rdb V7.0 multiversion environment and should run successfully.

Please note that with each release of Oracle Rdb, new entry points are added to the SQL$INT shareable image. This allows the implementation of new functionality. Therefore, applications linked with SQL$INT from Oracle Rdb V7.1 cannot be run on systems with only Oracle Rdb V7.0 installed. This is because the shareable image does not contain sufficient entry points.

The workaround presented here allows an application to explicitly link with the Oracle Rdb V7.0 version of the image. Such applications are upward compatible and will run on Oracle Rdb V7.0 and Oracle Rdb V7.1. The applications should be compiled and linked under the lowest version.

In environments where Oracle Rdb V7.1 is installed, this workaround is not required because the SQL$INT image will dynamically activate the appropriate SQL$SHRxx image as expected.

14.1.23 Clarification of PREPARE Statement Behavior

Bug 2581863

According to the Oracle Rdb7 SQL Reference Manual, Volume 3 page 7−227, when using a statement−id parameter for PREPARE "if that parameter is an integer, then you must explicitly initialize that integer to zero before executing the PREPARE statement".

This description is not correct and should be replaced with this information:

1. If the statement−id is non−zero and does not match any prepared statement (the id was stale or contained a random value), then an error is raised:
   %SQL−F−BADPREPARE, Cannot use DESCRIBE or EXECUTE on a statement that is not prepared
2. If the statement−id is non−zero, or the statement name is one that has previously been used and matches an existing prepared statement, then that statement is automatically released prior to the prepare of the new statement. Please refer to the RELEASE statement for further details.
3. If the statement−id is zero or was automatically released, then a new statement−id is allocated and the statement prepared.

Please note that if you use statement−name instead of a statement−id−parameter then SQL will implicitly declare an id for use by the application. Therefore, the semantics described apply similarly when using the statement−name. See the RELEASE statement for details.

14.1.24 RDM$BIND_LOCK_TIMEOUT_INTERVAL Overrides the Database Parameter

Bug 2203700

When starting a transaction, there are three different values that are used to determine the lock timeout interval for that transaction. Those values are:

1. The value specified in the SET TRANSACTION statement
2. The value stored in the database as specified in CREATE or ALTER DATABASE
3. The value of the logical name RDM$BIND_LOCK_TIMEOUT_INTERVAL

The timeout interval for a transaction is the smaller of the value specified in the SET TRANSACTION statement and the value specified in CREATE DATABASE. However, if the logical name RDM$BIND_LOCK_TIMEOUT_INTERVAL is defined, the value of this logical name overrides the value specified in CREATE DATABASE.

The description of how these three values interact, found in several different parts of the Rdb documentation set, is incorrect and will be replaced by the description above.

The lock timeout value in the database can be dynamically modified from the Locking Dashboard in RMU/SHOW STATISTICS. The Per−Process Locking Dashboard can be used to dynamically override the logical name RDM$BIND_LOCK_TIMEOUT_INTERVAL for one or more processes.

14.1.25 Missing Tables Descriptions for the RDBEXPERT Collection Class

Appendix B in the Oracle Rdb7 Guide to Database Performance and Tuning describes the event−based data tables in the formatted database for the Oracle Rdb PERFORMANCE and RDBEXPERT collection classes. This section describes the missing tables for the RDBEXPERT collection class.

Table 14−2 shows the TRANS_TPB table.

Table 14−2 Columns for Table EPC$1_221_TRANS_TPB

Column Name	Data Type	Domain
COLLECTION_RECORD_ID	SMALLINT	COLLECTION_RECORD_ID_DOMAIN
IMAGE_RECORD_ID	INTEGER	IMAGE_RECORD_ID_DOMAIN
CONTEXT_NUMBER	INTEGER	CONTEXT_NUMBER_DOMAIN
TIMESTAMP_POINT	DATE VMS	
CLIENT_PC	INTEGER	
STREAM_ID	INTEGER	

TRANS_ID	VARCHAR(16)	
TRANS_ID_STR_ID	INTEGER	STR_ID_DOMAIN
TPB	VARCHAR(127)	
TPB_STR_ID	INTEGER	STR_ID_DOMAIN

Table 14−3 shows the TRANS_TPB_ST table. An index is provided for this table. It is defined with column STR_ID, duplicates are allowed, and the type is sorted.

Table 14−3 Columns for Table EPC$1_221_TRANS_TPB_ST

Column Name	Data Type	Domain
STR_ID	INTEGER	STR_ID_DOMAIN
SEGMENT_NUMBER	SMALLINT	SEGMENT_NUMBER_DOMAIN
STR_SEGMENT	VARCHAR(128)	

14.1.26 Missing Columns Descriptions for Tables in the Formatted Database

Some of the columns were missing from the tables in Appendix B in the Oracle Rdb7 Guide to Database Performance and Tuning. The complete table definitions are described in this section.

Table 14−4 shows the DATABASE table.

Table 14−4 Columns for Table EPC$1_221_DATABASE

Column Name	Data Type	Domain
COLLECTION_RECORD_ID	SMALLINT	COLLECTION_RECORD_ID_DOMAIN
IMAGE_RECORD_ID	INTEGER	IMAGE_RECORD_ID_DOMAIN
CONTEXT_NUMBER	INTEGER	CONTEXT_NUMBER_DOMAIN
TIMESTAMP_POINT	DATE VMS	
CLIENT_PC	INTEGER	
STREAM_ID	INTEGER	
DB_NAME	VARCHAR(255)	
DB_NAME_STR_ID	INTEGER	STR_ID_DOMAIN
IMAGE_FILE_NAME	VARCHAR(255)	
IMAGE_FILE_NAME_STR_ID	INTEGER	STR_ID_DOMAIN

Table 14−5 shows the REQUEST_ACTUAL table.

Table 14−5 Columns for Table EPC$1_221_REQUEST_ACTUAL

Column Name	Data Type	Domain
COLLECTION_RECORD_ID	SMALLINT	COLLECTION_RECORD_ID_DOMAIN
IMAGE_RECORD_ID	INTEGER	IMAGE_RECORD_ID_DOMAIN
CONTEXT_NUMBER	INTEGER	CONTEXT_NUMBER_DOMAIN
TIMESTAMP_START	DATE VMS	
TIMESTAMP_END	DATE VMS	
DBS_READS_START	INTEGER	
DBS_WRITES_START	INTEGER	
RUJ_READS_START	INTEGER	
RUJ_WRITES_START	INTEGER	
AIJ_WRITES_START	INTEGER	
ROOT_READS_START	INTEGER	
ROOT_WRITES_START	INTEGER	
BUFFER_READS_START	INTEGER	
GET_VM_BYTES_START	INTEGER	
FREE_VM_BYTES_START	INTEGER	
LOCK_REQS_START	INTEGER	
REQ_NOT_QUEUED_START	INTEGER	
REQ_STALLS_START	INTEGER	
REQ_DEADLOCKS_START	INTEGER	
PROM_DEADLOCKS_START	INTEGER	
LOCK_RELS_START	INTEGER	
LOCK_STALL_TIME_START	INTEGER	
D_FETCH_RET_START	INTEGER	
D_FETCH_UPD_START	INTEGER	
D_LB_ALLOK_START	INTEGER	
D_LB_GBNEEDLOCK_START	INTEGER	
D_LB_NEEDLOCK_START	INTEGER	
D_LB_OLDVER_START	INTEGER	
D_GB_NEEDLOCK_START	INTEGER	
D_GB_OLDVER_START	INTEGER	
D_NOTFOUND_IO_START	INTEGER	
D_NOTFOUND_SYN_START	INTEGER	
S_FETCH_RET_START	INTEGER	
S_FETCH_UPD_START	INTEGER	
S_LB_ALLOK_START	INTEGER	
S_LB_GBNEEDLOCK_START	INTEGER	
S_LB_NEEDLOCK_START	INTEGER	
S_LB_OLDVER_START	INTEGER	
S_GB_NEEDLOCK_START	INTEGER	
S_GB_OLDVER_START	INTEGER	
S_NOTFOUND_IO_START	INTEGER	

S_NOTFOUND_SYN_START	INTEGER	
D_ASYNC_FETCH_START	INTEGER	
S_ASYNC_FETCH_START	INTEGER	
D_ASYNC_READIO_START	INTEGER	
S_ASYNC_READIO_START	INTEGER	
AS_READ_STALL_START	INTEGER	
AS_BATCH_WRITE_START	INTEGER	
AS_WRITE_STALL_START	INTEGER	
BIO_START	INTEGER	
DIO_START	INTEGER	
PAGEFAULTS_START	INTEGER	
PAGEFAULT_IO_START	INTEGER	
CPU_START	INTEGER	
CURRENT_PRIO_START	SMALLINT	
VIRTUAL_SIZE_START	INTEGER	
WS_SIZE_START	INTEGER	
WS_PRIVATE_START	INTEGER	
WS_GLOBAL_START	INTEGER	
CLIENT_PC_END	INTEGER	
STREAM_ID_END	INTEGER	
REQ_ID_END	INTEGER	
COMP_STATUS_END	INTEGER	
REQUEST_OPER_END	INTEGER	
TRANS_ID_END	VARCHAR(16)	
TRANS_ID_END_STR_ID	INTEGER	STR_ID_DOMAIN
DBS_READS_END	INTEGER	
DBS_WRITES_END	INTEGER	
RUJ_READS_END	INTEGER	
RUJ_WRITES_END	INTEGER	
AIJ_WRITES_END	INTEGER	
ROOT_READS_END	INTEGER	
ROOT_WRITES_END	INTEGER	
BUFFER_READS_END	INTEGER	
GET_VM_BYTES_END	INTEGER	
FREE_VM_BYTES_END	INTEGER	
LOCK_REQS_END	INTEGER	
REQ_NOT_QUEUED_END	INTEGER	
REQ_STALLS_END	INTEGER	
REQ_DEADLOCKS_END	INTEGER	
PROM_DEADLOCKS_END	INTEGER	
LOCK_RELS_END	INTEGER	
LOCK_STALL_TIME_END	INTEGER	

D_FETCH_RET_END	INTEGER
D_FETCH_UPD_END	INTEGER
D_LB_ALLOK_END	INTEGER
D_LB_GBNEEDLOCK_END	INTEGER
D_LB_NEEDLOCK_END	INTEGER
D_LB_OLDVER_END	INTEGER
D_GB_NEEDLOCK_END	INTEGER
D_GB_OLDVER_END	INTEGER
D_NOTFOUND_IO_END	INTEGER
D_NOTFOUND_SYN_END	INTEGER
S_FETCH_RET_END	INTEGER
S_FETCH_UPD_END	INTEGER
S_LB_ALLOK_END	INTEGER
S_LB_GBNEEDLOCK_END	INTEGER
S_LB_NEEDLOCK_END	INTEGER
S_LB_OLDVER_END	INTEGER
S_GB_NEEDLOCK_END	INTEGER
S_GB_OLDVER_END	INTEGER
S_NOTFOUND_IO_END	INTEGER
S_NOTFOUND_SYN_END	INTEGER
D_ASYNC_FETCH_END	INTEGER
S_ASYNC_FETCH_END	INTEGER
D_ASYNC_READIO_END	INTEGER
S_ASYNC_READIO_END	INTEGER
AS_READ_STALL_END	INTEGER
AS_BATCH_WRITE_END	INTEGER
AS_WRITE_STALL_END	INTEGER
BIO_END	INTEGER
DIO_END	INTEGER
PAGEFAULTS_END	INTEGER
PAGEFAULT_IO_END	INTEGER
CPU_END	INTEGER
CURRENT_PRIO_END	SMALLINT
VIRTUAL_SIZE_END	INTEGER
WS_SIZE_END	INTEGER
WS_PRIVATE_END	INTEGER
WS_GLOBAL_END	INTEGER

Table 14−6 shows the TRANSACTION table.

Table 14−6 Columns for Table EPC$1_221_TRANSACTION

Column Name	Data Type	Domain
COLLECTION_RECORD_ID	SMALLINT	COLLECTION_RECORD_ID_DOMAIN
IMAGE_RECORD_ID	INTEGER	IMAGE_RECORD_ID_DOMAIN
CONTEXT_NUMBER	INTEGER	CONTEXT_NUMBER_DOMAIN
TIMESTAMP_START	DATE VMS	
TIMESTAMP_END	DATE VMS	
CLIENT_PC_START	INTEGER	
STREAM_ID_START	INTEGER	
LOCK_MODE_START	INTEGER	
TRANS_ID_START	VARCHAR(16)	
TRANS_ID_START_STR_ID	INTEGER	STR_ID_DOMAIN
GLOBAL_TID_START	VARCHAR(16)	
GLOBAL_TID_START_STR_ID	INTEGER	STR_ID_DOMAIN
DBS_READS_START	INTEGER	
DBS_WRITES_START	INTEGER	
RUJ_READS_START	INTEGER	
RUJ_WRITES_START	INTEGER	
AIJ_WRITES_START	INTEGER	
ROOT_READS_START	INTEGER	
ROOT_WRITES_START	INTEGER	
BUFFER_READS_START	INTEGER	
GET_VM_BYTES_START	INTEGER	
FREE_VM_BYTES_START	INTEGER	
LOCK_REQS_START	INTEGER	
REQ_NOT_QUEUED_START	INTEGER	
REQ_STALLS_START	INTEGER	
REQ_DEADLOCKS_START	INTEGER	
PROM_DEADLOCKS_START	INTEGER	
LOCK_RELS_START	INTEGER	
LOCK_STALL_TIME_START	INTEGER	
D_FETCH_RET_START	INTEGER	
D_FETCH_UPD_START	INTEGER	
D_LB_ALLOK_START	INTEGER	
D_LB_GBNEEDLOCK_START	INTEGER	
D_LB_NEEDLOCK_START	INTEGER	
D_LB_OLDVER_START	INTEGER	
D_GB_NEEDLOCK_START	INTEGER	
D_GB_OLDVER_START	INTEGER	
D_NOTFOUND_IO_START	INTEGER	
D_NOTFOUND_SYN_START	INTEGER	
S_FETCH_RET_START	INTEGER	
S_FETCH_UPD_START	INTEGER	

S_LB_ALLOK_START	INTEGER	
S_LB_GBNEEDLOCK_START	INTEGER	
S_LB_NEEDLOCK_START	INTEGER	
S_LB_OLDVER_START	INTEGER	
S_GB_NEEDLOCK_START	INTEGER	
S_GB_OLDVER_START	INTEGER	
S_NOTFOUND_IO_START	INTEGER	
S_NOTFOUND_SYN_START	INTEGER	
D_ASYNC_FETCH_START	INTEGER	
S_ASYNC_FETCH_START	INTEGER	
D_ASYNC_READIO_START	INTEGER	
S_ASYNC_READIO_START	INTEGER	
AS_READ_STALL_START	INTEGER	
AS_BATCH_WRITE_START	INTEGER	
AS_WRITE_STALL_START	INTEGER	
AREA_ITEMS_START	VARCHAR(128)	
AREA_ITEMS_START_STR_ID	INTEGER	STR_ID_DOMAIN
BIO_START	INTEGER	
DIO_START	INTEGER	
PAGEFAULTS_START	INTEGER	
PAGEFAULT_IO_START	INTEGER	
CPU_START	INTEGER	
CURRENT_PRIO_START	SMALLINT	
VIRTUAL_SIZE_START	INTEGER	
WS_SIZE_START	INTEGER	
WS_PRIVATE_START	INTEGER	
WS_GLOBAL_START	INTEGER	
CROSS_FAC_2_START	INTEGER	
CROSS_FAC_3_START	INTEGER	
CROSS_FAC_7_START	INTEGER	
CROSS_FAC_14_START	INTEGER	
DBS_READS_END	INTEGER	
DBS_WRITES_END	INTEGER	
RUJ_READS_END	INTEGER	
RUJ_WRITES_END	INTEGER	
AIJ_WRITES_END	INTEGER	
ROOT_READS_END	INTEGER	
ROOT_WRITES_END	INTEGER	
BUFFER_READS_END	INTEGER	
GET_VM_BYTES_END	INTEGER	
FREE_VM_BYTES_END	INTEGER	
LOCK_REQS_END	INTEGER	

REQ_NOT_QUEUED_END	INTEGER	
REQ_STALLS_END	INTEGER	
REQ_DEADLOCKS_END	INTEGER	
PROM_DEADLOCKS_END	INTEGER	
LOCK_RELS_END	INTEGER	
LOCK_STALL_TIME_END	INTEGER	
D_FETCH_RET_END	INTEGER	
D_FETCH_UPD_END	INTEGER	
D_LB_ALLOK_END	INTEGER	
D_LB_GBNEEDLOCK_END	INTEGER	
D_LB_NEEDLOCK_END	INTEGER	
D_LB_OLDVER_END	INTEGER	
D_GB_NEEDLOCK_END	INTEGER	
D_GB_OLDVER_END	INTEGER	
D_NOTFOUND_IO_END	INTEGER	
D_NOTFOUND_SYN_END	INTEGER	
S_FETCH_RET_END	INTEGER	
S_FETCH_UPD_END	INTEGER	
S_LB_ALLOK_END	INTEGER	
S_LB_GBNEEDLOCK_END	INTEGER	
S_LB_NEEDLOCK_END	INTEGER	
S_LB_OLDVER_END	INTEGER	
S_GB_NEEDLOCK_END	INTEGER	
S_GB_OLDVER_END	INTEGER	
S_NOTFOUND_IO_END	INTEGER	
S_NOTFOUND_SYN_END	INTEGER	
D_ASYNC_FETCH_END	INTEGER	
S_ASYNC_FETCH_END	INTEGER	
D_ASYNC_READIO_END	INTEGER	
S_ASYNC_READIO_END	INTEGER	
AS_READ_STALL_END	INTEGER	
AS_BATCH_WRITE_END	INTEGER	
AS_WRITE_STALL_END	INTEGER	
AREA_ITEMS_END	VARCHAR(128)	
AREA_ITEMS_END_STR_ID	INTEGER	STR_ID_DOMAIN
BIO_END	INTEGER	
DIO_END	INTEGER	
PAGEFAULTS_END	INTEGER	
PAGEFAULT_IO_END	INTEGER	
CPU_END	INTEGER	
CURRENT_PRIO_END	SMALLINT	
VIRTUAL_SIZE_END	INTEGER	

WS_SIZE_END	INTEGER
WS_PRIVATE_END	INTEGER
WS_GLOBAL_END	INTEGER
CROSS_FAC_2_END	INTEGER
CROSS_FAC_3_END	INTEGER
CROSS_FAC_7_END	INTEGER
CROSS_FAC_14_END	INTEGER

Table 14−7 shows the REQUEST_BLR table.

Table 14−7 Columns for Table EPC$1_221_REQUEST_BLR

Column Name	Data Type	Domain
COLLECTION_RECORD_ID	SMALLINT	COLLECTION_RECORD_ID_DOMAIN
IMAGE_RECORD_ID	INTEGER	IMAGE_RECORD_ID_DOMAIN
CONTEXT_NUMBER	INTEGER	CONTEXT_NUMBER_DOMAIN
TIMESTAMP_POINT	DATE VMS	
CLIENT_PC	INTEGER	
STREAM_ID	INTEGER	
REQ_ID	INTEGER	
TRANS_ID	VARCHAR(16)	
TRANS_ID_STR_ID	INTEGER	STR_ID_DOMAIN
REQUEST_NAME	VARCHAR(31)	
REQUEST_NAME_STR_ID	INTEGER	STR_ID_DOMAIN
REQUEST_TYPE	INTEGER	
BLR	VARCHAR(127)	
BLR_STR_ID	INTEGER	STR_ID_DOMAIN

14.2 Address and Phone Number Correction for Documentation

In release 7.0 or earlier documentation, the address and fax phone number listed on the Send Us Your Comments page are incorrect. The correct information is:

```
FAX -- 603.897.3825
Oracle Corporation
One Oracle Drive
Nashua, NH 03062-2804
USA
```

14.3 Online Document Format and Ordering Information

You can view the documentation in Adobe Acrobat format using the Acrobat Reader, which allows anyone to view, navigate, and print documents in the Adobe Portable Document Format (PDF). See http://www.adobe.com for information about obtaining a free copy of Acrobat Reader and for information on supported platforms.

The Oracle Rdb documentation in Adobe Acrobat format is available on MetaLink:

```
Top Tech Docs\Oracle Rdb\Documentation\<bookname>
```

Customers should contact their Oracle representative to purchase printed documentation.

Chapter 15
Known Problems and Restrictions

This chapter describes problems and restrictions relating to Oracle Rdb and includes workarounds where appropriate.

15.1 Known Problems and Restrictions in All Interfaces

This section describes known problems and restrictions that affect all interfaces. This is not an exhaustive list. Check the Oracle Bug database to see a list of all open Rdb bugs and their current status.

15.1.1 Null Elimination Warning Not Generated for Some Aggregates

The current release of Oracle Rdb does not correctly return the null elimination warning for aggregates that are optimized to use special index operations against SORTED indices, even when the dialect requests this returned warning.

The null elimination warning is returned when using one of the following SQL dialects: SQL92, SQL99, ORACLE LEVEL1, or ORACLE LEVEL2.

The list of affected aggregate functions are:

- MAX (column)
- MAX (DISTINCT column)
- MIN (column)
- MIN (DISTINCT column)

When these functions are encountered and the optimizer is able to apply "Max key lookup" or "Min key lookup" then Rdb currently disables the return of null elimination warning in preference to improved query performance.

In addition, COUNT(column) and COUNT(DISTINCT column) do not correctly return the null elimination warning against SORTED RANKED indices.

This restriction does not affect COUNT(*) which correctly reports the null elimination warning when "Index count lookup" or "Index distinct lookup" is used.

15.1.2 Aggregate Query With Filter Predicates Returns Wrong Result

Bug 14133515

Oracle Rdb may return the wrong results if an aggregate FILTER clause is used that references the same column being aggregated and that column has a SORTED or SORTED RANKED index.

In such cases, the optimization strategies "Max Key Lookup", "Min Key Lookup", "Index counts lookup", and "Index distinct lookup" will be chosen and these strategies do not currently apply the FILTER clause.

Consider these examples which report 3 rows:

```
SQL> select middle_initial from employees where middle_initial = 'R';
```

```
Tables:
  0 = EMPLOYEES
Index only retrieval of relation 0:EMPLOYEES
  Index name  MI_INDEX [1:1]
    Keys: 0.MIDDLE_INITIAL = 'R'
 MIDDLE_INITIAL
 R
 R
 R
3 rows selected
SQL>
SQL> select count(middle_initial) from employees where middle_initial = 'R';
Tables:
  0 = EMPLOYEES
Aggregate: 0:COUNT (0.MIDDLE_INITIAL) Q2
Index only retrieval of relation 0:EMPLOYEES
  Index name  MI_INDEX [1:1]     Index counts lookup
    Keys: 0.MIDDLE_INITIAL = 'R'

           3
1 row selected
SQL>
```

However, these queries return the wrong result (100 rows) if the predicate is applied as a filter.

```
SQL> select count(middle_initial) filter (where middle_initial = 'R')
cont> from EMPLOYEES;
Tables:
  0 = EMPLOYEES
Aggregate: 0:COUNT (0.MIDDLE_INITIAL) Q2
              Bool: 0.MIDDLE_INITIAL = 'R'
Index only retrieval of relation 0:EMPLOYEES
  Index name  MI_INDEX [0:0]     Index counts lookup

         100
1 row selected
SQL>
```

Similar aggregate queries with MAX and MIN functions with FILTER predicates also fail.

These problems will corrected in the next major release of Oracle Rdb.

15.1.3 Possible Incorrect Results When Using Partitioned Descending Indexes

Bug 6129797

In the current release of Oracle Rdb, it is possible for some queries using partitioned indexes with segments of mixed ascending and descending order to return incorrect results either on Alpha or I64 systems.

The following examples show two problems when using partitioned index with segments of mixed ascending and descending order:

```
create database file foo
  create storage area fooa
  create storage area foob;
```

```
create table mesa (id integer, m4 char (1), m5 integer);
create table rasa (id integer, r4 char (1), r5 integer);

insert into mesa (id, m4, m5) values  (1, 'm', 1 );

insert into rasa (id, r4, r5) values  (1, 'm', 1 );
insert into rasa (id, r4, r5) values  (1, 'k', 1 );
insert into rasa (id, r4, r5) values  (1, 'e', 1 );

create index x4 on mesa (id asc , m4 asc) ;

! The following index contains ascending segments followed by descending
! segments and thus causes the query to return the wrong result.
!
! Note that the query works if both segments are either ascending or descending.
!
create index y4 on rasa (id asc , r4 desc)
       store using (id, r4)
       in fooa with limit of (1, 'g' )
       otherwise in foob ;
commit;

! Problem #1:
!
! the following query returns correctly 3 rows on Alpha but 1 row on IA64:

SQL> select m.id, m.m4, r.r4 from
   mesa m inner join rasa r on (m.id = r.id);
           1   m      m
           1   m      k
           1   m      e
3 rows selected

SQL> select m.id, m.m4, r.r4 from mesa m inner join rasa r on (m.id = r.id);
           1   m      e
1 row selected

! Problem #2:
!
! The following query using reverse scan returns 2 rows incorrectly on Alpha
! but 3 rows correctly on IA64:
!

SQL> select id, r4 from rasa where id = 1 and r4 <= 'm' order by id, r4;
Tables:
  0 = RASA
Index only retrieval of relation 0:RASA
  Index name  Y4 [2:1]   Reverse Scan
    Keys: (0.ID = 1) AND (0.R4 <= 'm')
       ID   R4
        1   k
        1   m
2 rows selected

SQL> select id, r4 from rasa where id = 1 and r4 <= 'm' order by id, r4;
Tables:
  0 = RASA
Index only retrieval of relation 0:RASA
  Index name  Y4 [2:1]   Reverse Scan
    Keys: (0.ID = 1) AND (0.R4 <= 'm')
       ID   R4
        1   e
```

```
        1   k
        1   m
3 rows selected
```

This problem is related to the construction and comparison of the descending key values while processing the index partitions.

The problem will be corrected in a future version of Oracle Rdb.

15.1.4 Remote Attach Stalls Before Detecting a Node is Unreachable

Bug 7681548

A remote attach can stall for a noticeable period, typically 75 seconds, before detecting a node is unreachable.

The following example shows the expected error message when attempting to access a database on a node that is not reachable. The problem is that when the value of the parameter SQL_NETWORK_TRANSPORT_TYPE in the file RDB$CLIENT_DEFAULTS.DAT is not specifically set to DECNET (in UPPER CASE), a stall of typically 75 seconds will happen before you get the expected error message.

```
SQL> attach 'file 1::disk1:[dbdir]db';
%SQL-F-ERRATTDEC, Error attaching to database 1::disk1:[dbdir]db
-RDB-F-IO_ERROR, input or output error
-SYSTEM-F-UNREACHABLE, remote node is not currently reachable
```

There are two possible ways to avoid the stall and get the error message after a user configurable period of time or instantly: decrease the value of the TCPIP parameter TCP_KEEPINIT, or explicitly specify SQL_NETWORK_TRANSPORT_TYPE as DECNET (in UPPER CASE).

- The default behavior when attempting to connect to an unreachable node via TCPIP is to stall 75 seconds before returning an error. The stall time is configurable in TCPIP via the parameter TCP_KEEPINIT which is expressed in units of 500 ms. The default value of TCP_KEEPINIT is 150 which corresponds to a 75 second stall.
- When connecting via DECnet, the error message is typically returned instantly so a significant stall will not be seen in this case. However, the value of the parameter SQL_NETWORK_TRANSPORT_TYPE is case sensitive so for DECnet to be selected as the transport, "DECNET" must be specified in UPPER CASE. Failing to do so will result in connecting via the DEFAULT method which is to first try connecting via DECnet and if that fails attempt to connect via TCPIP and hence a 75 second stall will take place unless TPC_KEEPINIT is set to a value lower than 150.

15.1.5 Case Sensitive Values in RDB$CLIENT_DEFAULTS.DAT

Bug 7681548

Various characteristics for network access to remote databases can be specified by entering parameters and values in a file named RDB$CLIENT_DEFAULTS.DAT. The following keywords that have character strings as their values only take effect if the values are specified in UPPER CASE: SQL_NETWORK_TRANSPORT_TYPE, SQL_MESSAGE_VECTOR_RETURN_TYPE, and SQL_DEFAULTS_RESTRICTION. The result of including one or more lower case characters in the value of one of these parameters is the same as if the parameter was not specified at all (for example, the default behavior would be applied and no error message would be issued).

In the following example, DECnet is specified with the last three characters in lower case. The result will be that the value of the parameter SQL_NETWORK_TRANSPORT_TYPE will be DEFAULT and not the intended value DECNET.

```
SQL_NETWORK_TRANSPORT_TYPE DECnet
```

This problem can be avoided by specifying the values for SQL_NETWORK_TRANSPORT_TYPE, SQL_MESSAGE_VECTOR_RETURN_TYPE, and SQL_DEFAULTS_RESTRICTION in RDB$CLIENT_DEFAULTS.DAT using UPPER CASE.

In the next major release of Oracle Rdb, the values in RDB$CLIENT_DEFAULTS.DAT will be case insensitive.

15.1.6 Standalone WITH Clause in Compound Statements Now Deprecated

In prior versions of Oracle Rdb, it was permitted to follow the BEGIN keyword in a top level compound statement or stored routine with a WITH HOLD clause to specify that the procedure treated all FOR loops as HOLD cursors.

Unfortunately, this syntax conflicts with recent syntax added to the ANSI and ISO SQL Database Language standard. Support for this new syntax (known as subquery factoring) is used by Oracle tools accessing Oracle Rdb through OCI Services for Rdb. Therefore, to accommodate this change Oracle will remove the WITH HOLD syntax as a standalone clause after the BEGIN keyword. The alternate syntax, available since Oracle Rdb V7.1, is to use the PRAGMA clause which allows the WITH HOLD clause to be specified.

Any applications or SQL command files must be modified prior to the next major release of Oracle Rdb. At that time, the old syntax will be removed and the new WITH clause (aka subquery factoring) will be introduced.

The following example shows the old syntax, which now produces a deprecated message.

```
SQL> begin
cont> with hold preserve none
%SQL-I-DEPR_FEATURE, Deprecated Feature: WITH HOLD no longer supported in
this context - use PRAGMA (WITH HOLD) instead
cont> trace 'a';
cont> end;
```

It should be replaced with the following syntax which provides the same behavior.

```
SQL> begin
cont> pragma (with hold preserve none)
cont> trace 'a';
```

```
cont> end;
```

15.1.7 Calling DECC$CRTL_INIT

In cases where user−supplied code is being called by Oracle Rdb (such as an external function, a module called implementing the Oracle Backup API, or a user−supplied output routine for the Oracle Rdb LogMiner), if calls are made to certain DECC$SHR RTL routines, it may be required to first call DECC$CRTL_INIT.

DECC$CRTL_INIT is a C run time library routine that allows developers to call the HP C RTL from other languages or to use the HP C RTL when the main function is not in C. It initializes the run−time environment and establishes both an exit and condition handler. The Oracle Rdb main images are not written in C and should not be expected to have called DECC$CRTL_INIT prior to the user's code being invoked. The requirement for DECC$CRTL_INIT in certain cases exists in all versions of Oracle Rdb.

A shareable image need only call this function if it contains an HP C function call for signal handling, environment variables, I/O, exit handling, a default file protection mask, or if it is a child process that should inherit context. Although many of the initialization activities are performed only once, DECC$CRTL_INIT can safely be called multiple times.

See the HP C Run−Time Library Reference Manual for OpenVMS Systems manual for additional information.

15.1.8 Application and Oracle Rdb Both Using SYS$HIBER

In application processes that use Oracle Rdb and the SYS$HIBER system service (possibly via RTL routines such as LIB$WAIT), it is very important that the application ensures that the event being waited for has actually occurred. Oracle Rdb utilizes $HIBER/$WAKE sequences for interprocess communication and synchronization.

Because there is just a single process−wide "hibernate" state along with a single process−wide "wake pending" flag, Oracle Rdb must assume that it "shares" use of the hibernate/wake state with the user's application code. To this end, Oracle Rdb generally will re−wake the process via a pending wake request after using a hibernate sequence.

Oracle Rdb's use of the $WAKE system service will interfere with other users of $HIBER (such as the routine LIB$WAIT) that do not check for event completion, possibly causing a $HIBER to be unexpectedly resumed without waiting at all.

To avoid these situations, applications that use HIBER/WAKE facilities must use a code sequence that avoids continuing without a check for the operation (such as a delay or a timer firing) being complete.

The following pseudo−code shows one example of how a flag can be used to indicate that a timed−wait has completed correctly. The wait does not complete until the timer has actually fired and set TIMER_FLAG to TRUE. This code relies on ASTs being enabled.

```
ROUTINE TIMER_WAIT:
    BEGIN
    ! Clear the timer flag
    TIMER_FLAG = FALSE
```

```
    ! Schedule an AST for sometime in the future
    STAT = SYS$SETIMR (TIMADR = DELTATIME, ASTRTN = TIMER_AST)
    IF STAT <> SS$_NORMAL THEN LIB$SIGNAL (STAT)

    ! Hibernate.  When the $HIBER completes, check to make
    ! sure that TIMER_FLAG is set indicating that the wait
    ! has finished.
    WHILE TIMER_FLAG = FALSE
    DO  SYS$HIBER()
    END

ROUTINE TIMER_AST:
    BEGIN
    ! Set the flag indicating that the timer has expired
    TIMER_FLAG = TRUE

    ! Wake the main-line code
    STAT = SYS$WAKE ()
    IF STAT <> SS$_NORMAL THEN LIB$SIGNAL (STAT)
    END
```

Starting with OpenVMS V7.1, the LIB$WAIT routine includes a FLAGS argument (with the LIB$K_NOWAKE flag set) to allow an alternate wait scheme (using the $SYNCH system service) that can avoid potential problems with multiple code sequences using the $HIBER system service. See the OpenVMS RTL Library (LIB$) Manual for more information about the LIB$WAIT routine.

In order to prevent application hangs, inner−mode users of SYS$HIBER must take explicit steps to ensure that a pending wake is not errantly " consumed ". The general way of accomplishing this is to issue a SYS$WAKE to the process after the event is complete if a call to SYS$HIBER was done. Rdb takes this step and therefore application programs must be prepared for cases where a wakeup might appear unexpectedly.

15.1.9 Unexpected RCS Termination

It has been observed in internal testing of Rdb Release 7.2.2 that if the Record Cache Server (the RCS) terminates in an uncontrolled fashion this may, under some conditions, cause corruption of the database and/or the After Image Journal file.

When the RCS terminates, the database is shut down and a message like the following is written to the monitor log:

```
6−DEC−2007 15:04:17.02 − Received Record Cache Server image termination from
22ED5144:1
  − database name "device:[directory]database.RDB;1" [device] (1200,487,0)
  − abnormal Record Cache Server termination detected
  − starting delete−process shutdown of database:
    − %RDMS−F−RCSABORTED, record cache server process terminated abnormally
  − sending process deletion to process 22ED10F9
  − sending process deletion to process 22ECED59
  − sending process deletion to process 22EC0158
  − sending process deletion to process 22EB9543 (AIJ Log server)
  − database shutdown waiting for active users to terminate
```

A future attempt to roll forward the AIJ following a restore of a database backup might fail with a bugcheck dump if this problem has happened.

The only currently known situation where this problem has been observed is if the logical name RDM$BIND_RCS_VALIDATE_SECS is defined to some value and the logical name RDM$BIND_RCS_LOG_FILE at the same time is undefined or defined incorrectly.

To prevent this problem, Oracle recommends any customer using the Row Cache feature to either avoid defining the logical name RDM$BIND_RCS_VALIDATE_SECS or if this logical name for any reason needs to be defined, to make sure RDM$BIND_RCS_LOG_FILE is correctly defined (i.e. defined with the /SYSTEM and /EXECUTIVE qualifiers and is pointing to a valid file name in an existing directory on a cluster accessible device with sufficient free space).

This recommendation applies to all versions of Oracle Rdb.

15.1.10 Changes for Processing Existence Logical Names

This release of Oracle Rdb will change the handling of so called "existence" logical names used to tune the Rdb environment. These existence logical names could in past versions be defined to any value to enable their effect. The Rdb documentation in most cases described using the value 1 or YES as that value and this change is upward compatible with the documentation.

Rdb now treats these logical names (see the list below) as Boolean logicals and accepts a string starting with "Y", "y", "T", "t" or "1" to mean TRUE. All other values will be considered to be FALSE. This change allows process level definitions to override definitions in higher logical name tables which was not possible previously.

Oracle recommends that customers examine all procedures that define the following logical names to ensure that their values conform to these rules prior to upgrading to Oracle Rdb V7.2.1.1 or later to avoid unexpected changes in behavior.

- RDMS$AUTO_READY
- RDMS$DISABLE_HIDDEN_KEY
- RDMS$DISABLE_MAX_SOLUTION
- RDMS$DISABLE_REVERSE_SCAN
- RDMS$DISABLE_TRANSITIVITY
- RDMS$DISABLE_ZIGZAG_BOOLEAN
- RDMS$ENABLE_BITMAPPED_SCAN
- RDMS$ENABLE_INDEX_COLUMN_GROUP
- RDMS$MAX_STABILITY
- RDMS$USE_OLD_COST_MODEL
- RDMS$USE_OLD_COUNT_RELATION
- RDMS$USE_OLD_SEGMENTED_STRING
- RDMS$USE_OLD_UPDATE_RULES

15.1.11 Patch Required When Using VMS V8.3 and Dedicated CPU Lock Manager

During qualification testing of Oracle Rdb Release 7.2.1 on OpenVMS V8.3 systems, a problem with the use of Extended Lock Value Blocks and the OpenVMS Dedicated CPU Lock Manager feature was discovered.

To avoid this problem, Oracle strongly recommends that customers wishing to use Oracle Rdb and the OpenVMS Dedicated CPU Lock Manager feature with OpenVMS V8.3 install one of the following architecture−specific patch kit (or subsequent replacement if superseded) prior to using Oracle Rdb Release 7.2.1 on OpenVMS V8.3 systems:

- VMS83I_SYS−V0200 (I64)
- VMS83A_SYS−V0100 (Alpha)

15.1.12 SQL Module or Program Fails with %SQL−F−IGNCASE_BAD

Bug 2351258

A SQL Module or Pre−compiled SQL program built with Rdb 6.1 or earlier may fail when running under Rdb 7.2 if the program submits queries that involve certain kinds of character operations on parameters in the queries. For example, a LIKE operator in the WHERE clause of a SQL statement requires SQL to look for character− or string−matching wildcard characters. Another example is the use of IGNORE CASE which causes SQL to equivalence upper and lower case characters for the character set in use.

The following example shows a portion of a SQL module language program that queries a PERSONNEL database.

```
DECLARE MANL_NAME_LIST CURSOR FOR
 SELECT DISTINCT E.LAST_NAME,E.FIRST_NAME,J.JOB_CODE,J.DEPARTMENT_CODE,E.CITY
FROM   DB1_HANDLE.EMPLOYEES E,DB1_HANDLE.JOB_HISTORY J
 WHERE J.EMPLOYEE_ID = E.EMPLOYEE_ID
   AND E.STATUS_CODE = STATUS_CODE
   AND E.CITY LIKE CITYKEY IGNORE CASE
   ORDER BY E.EMPLOYEE_ID DESC, E.LAST_NAME DESC

PROCEDURE SQL_OPN_NAME_LIST
SQLCODE
CITYKEY       CHAR(20)
STATUS_CODE   CHAR(1);
OPEN MANL_NAME_LIST;
```

If the SQL Module containing the code above is compiled and linked into an executable using a pre−7.0 version of Rdb, it will run properly against that version. However if the same program is run in an Rdb 7.2 environment, a call to the SQL_OPN_NAME_LIST procedure will return a SQLCODE of −1. The RDB$MESSAGE_VECTOR will contain a code associated with the following message:

```
%SQL−F−IGNCASE_BAD, IGNORE CASE not supported for character set
```

To workaround this problem, re−link the program using a 7.2 version of SQL$INT.EXE and/or SQL$USER.OLB.

15.1.13 External Routine Images Linked with PTHREAD$RTL

The OpenVMS Guide to the POSIX Threads Library describes that it is not supported to dynamically activate the core run−time library shareable image PTHREAD$RTL. Oracle has found in testing that a shareable image supplied for use as an External Routine that is linked with PTHREAD$RTL can be expected to cause a hang during dynamic image activation on OpenVMS I64 systems. This problem has not been observed on OpenVMS Alpha systems.

To avoid this problem in any case where the shareable image used for an Rdb External Routine is linked with PTHREAD$RTL, the main program image must likewise be linked with PTHREAD$RTL. This requirement applies to customer built application main programs as well as the main interactive SQL image.

The shareable image RDB$NATCONN_FUNC72.EXE supplied with OCI Services for Oracle Rdb (part of SQL/Services) is one such shareable image that is linked with PTHREAD$RTL. Customer built applications that utilize External Routines from the RDB$NATCONN_FUNC72.EXE image must ensure that the main image is linked with PTHREAD$RTL. The external routines that a user may call that use functions from RDB$NATCONN_FUNC72.EXE include:

- TO_CHAR
- TO_NUMBER
- TO_DATE

You can use the OpenVMS command ANALYZE/IMAGE to determine whether an image depends upon PTHREAD$RTL. For more information, see the OpenVMS documentation.

15.1.14 Using Databases from Releases Earlier than V7.0

You cannot convert or restore databases earlier than the Oracle Rdb V7.0 format directly to Oracle Rdb V7.2 format. The RMU Convert command for Oracle Rdb V7.2 supports conversions from Oracle Rdb V7.0 and V7.1 format databases only. If you have an Oracle Rdb V3.0 through V6.1 format database, you must convert it to at least Oracle Rdb V7.0 format and then convert it to Oracle Rdb V7.2 format. For example, if you have a V4.2 format database, you must convert it first to at least Oracle Rdb V7.0 format, then convert it to Oracle Rdb V7.2 format.

If you attempt to convert or restore a database that is prior to Oracle Rdb V7.0 format directly to Oracle Rdb V7.2 format, Oracle RMU generates an error.

15.1.15 Partitioned Index with Descending Column and Collating Sequence

Bug 2797443

A known problem exists in which a query can return wrong results (number of rows returned is incorrect). This can happen on a table that has a multi−column, partitioned index in which one of the columns is sorted in descending order and the column has an associated collating sequence.

The following example can be used to demonstrate the problem.

```
$ sql$
create database file mf_collating.rdb alloc 10
  collating sequence french french
  create storage area area1 alloc 10
```

```
  create storage area area2 alloc 10
  create storage area area3 alloc 10;
create table tab1 (id tinyint, r3 char (3));
insert into tab1 (id, r3) values (1, 'a');
insert into tab1 (id, r3) values (1, 'b');
insert into tab1 (id, r3) values (1, 'f');
create index y3 on tab1 (id asc, r3 desc)
       store using (id, r3)
       in area1 with limit of (1, 'k')
       in area2 with limit of (1, 'e')
       otherwise in area3 ;
commit;

set flags 'strategy';

! Here is a query that returns the correct rows using sequential rather
! than indexed access.

select id, r3 from tab1 where id = 1 and r3 <= 'e'
  optimize for sequential access;
Conjunct        Get     Retrieval sequentially of relation TAB1
   ID   R3
    1   a
    1   b
2 rows selected

! Here is the same query without the sequential access restriction.
! Note in the query strategy that index Y3 is used for data retrieval.
! This query ought to (but does not) return the same set of rows as
! for the sequential access query.

select id, r3 from tab1 where id = 1 and r3 <= 'e';
Leaf#01 FFirst TAB1 Card=3
  BgrNdx1 Y3 [2:1] Fan=16
0 rows selected
```

15.1.16 Domain−Qualified TCP/IP Node Names in Distributed Transactions

Bug 3735144

When using TCP/IP for Oracle Rdb remote connections, distributed transactions involving databases on nodes which are not on the same subnet may not work.

Remote Rdb has the capability to make remote connections via TCP/IP in lieu of DECnet. (See the Oracle Rdb OpenVMS Installation and Configuration Guide for how to set this up.) However, distributed transactions involving remote databases connected to via TCP/IP have been difficult. This is because Rdb relies on OpenVMS DECdtm for distributed transaction support and DECdtm requires DECnet for off−node communication. (This is an OpenVMS and not an Rdb restriction. Contact Hewlett−Packard OpenVMS Support for more details.)

OpenVMS provides a capability to run DECnet over TCP/IP so that OpenVMS services which require DECnet (like DECdtm) can operate in an environment where a TCP/IP network is used as the communications backbone. This capability allows DECdtm (and hence Rdb) to manage distributed transactions via TCP/IP. (See HP's OpenVMS DECnet−Plus documentation set for how to configure and use

this capability.)

However, for a transaction involving a remote database, Rdb only provides the SCSNODE name of the remote node to DECdtm. For example, consider the following SQL attaches to two remote databases using TCP/IP:

```
SQL> attach 'alias db1 filename node1.a.b.c::db_root:db1 user ''me'' using
''pw''';
SQL> attach 'alias db2 filename node1.a.b.c::db_root:db2 user ''me'' using
''pw''';
```

In the above example, Rdb can successfully connect to both remote databases using the TCP/IP address "node1.a.b.c." but when multiple databases are attached, Rdb implicitly uses distributed transactions via DECdtm. Since Rdb only passes DECdtm the SCSNODE name retrieved from the RDBSERVERnn at the other end of the connection, DECdtm does not, in general, have the information it needs to resolve the remote reference. It will only be able to do so if the SCSNODE name and the TCP/IP node name are the same and the local node is on the same subnet (i.e. ".a.b.c" in the example). Otherwise, after the second attach is made, the following error message will be received as soon as a transaction is started:

```
SQL> set trans read write;
%RDB-F-SYS_REQUEST_CAL, error from system services request - called from 100001
-RDB-E-DECDTMERR, DECdtm system service call error
-IPC-E-BCKTRNSFAIL, failure on the back translate address request
```

There are three potential workarounds:

- If distributed transactions are unimportant to the application, they can be disabled by defining the logical name SQL$DISABLE_CONTEXT to TRUE. Rdb will then not call DECdtm and the node name resolution problem will not be seen. However, it will be the problem of the application to maintain database integrity in the event that a commit succeeds on one database and not on another. See the Rdb Guide to Distributed Transactions for more information.
- If all the nodes involved in the distributed transaction are in the same domain, then TCP/IP can resolve the node with only the first part of the node provided that the SCSNODE name is identical to it. In the example above, this would mean that the remote node had an SCSNODE name of "NODE1" and that the local node was on TCP/IP subnet ".a.b.c".
- It may also be possible to define a DNS/BIND alias name for the remote node's SCSNODE name to the local node's TCP/IP database. This should allow the SCSNODE name passed by Rdb Dispatch to be translated successfully. For example, assuming HP TCP/IP Services for OpenVMS is the TCP/IP protocol stack then a command like the following could be used on the local node:

  ```
  $ TCP SET HOST NODE1.A.B.C/address=nnn.nnn.nnn.nnn/alias=NODE1_SCS
  ```

  Where "nnn.nnn.nnn.nnn" is the IP address and "NODE1_SC" the OpenVMS SCSNODE name of the remote node. See the HP DECnet-Plus documentation set for more information on how to maintain TCP/IP domain databases.

15.1.17 ILINK-E-INVOVRINI Error on I64

When linking an application with multiple modules, the following error message may be returned:

```
%ILINK-E-INVOVRINI, incompatible multiple initializations for overlaid section
        section: VMSRDB
        module: M1
        file: DKA0:[BLD]M1.OBJ;1
        module: M2
        file: DKA0:[BLD]SYS.OLB;1
```

On I64 systems, it is not allowed to have a program section that attempts to be initialized a subsequent time where the non−zero portions of the initializations do not match. This is a difference from OpenVMS Alpha and VAX systems where the linker permitted such initializations.

If the modules specified are SQL module language or precompiler produced, the application build procedures usually need to be modified. Typically, the solution is to initialize the database handles in only one of the modules. The SQLMOD command line qualifiers /NOINITIALIZE_HANDLES and /INITIALIZE_HANDLES are used to specify whether or not alias definitions are coerced into alias references.

15.1.18 New Attributes Saved by RMU/LOAD Incompatible With Prior Versions

Bug 2676851

To improve the behavior of unloading views, Oracle Rdb Release 7.1.2 changed the way view columns were unloaded so that attributes for view computed columns, COMPUTED BY and AUTOMATIC columns were saved. These new attributes are not accepted by prior releases of Oracle Rdb.

The following example shows the reported error trying to load a file from V7.1.2 under V7.1.0.4.

```
%RMU-F-NOTUNLFIL, Input file was not created by RMU UNLOAD
%RMU-I-DATRECSTO,   0 data records stored.
%RMU-F-FTL_LOAD, Fatal error for LOAD operation at 21-OCT-2003 16:34:54.20
```

You can workaround this problem by using the /RECORD_DEFINITION qualifier and specifying the FORMAT=DELIMITED option. However, this technique does not support LIST OF BYTE VARYING column unloading.

15.1.19 SYSTEM−F−INSFMEM Fatal Error With SHARED MEMORY IS SYSTEM or LARGE MEMORY IS ENABLED in Galaxy Environment

When using the GALAXY SUPPORT IS ENABLED feature in an OpenVMS Galaxy environment, a *%SYSTEM−F−INSFMEM, insufficient dynamic memory error* may be returned when mapping record caches or opening the database. One source of this problem specific to a Galaxy configuration is running out of Galaxy Shared Memory regions. For Galaxy systems, GLX_SHM_REG is the number of shared memory region structures configured into the Galaxy Management Database (GMDB).

While the default value (for OpenVMS versions through at least V7.3−1) of 64 regions might be adequate for some installations, sites using a larger number of databases or row caches when the SHARED MEMORY IS SYSTEM or LARGE MEMORY IS ENABLED features are enabled may find the default insufficient.

If a *%SYSTEM−F−INSFMEM, insufficient dynamic memory* error is returned when mapping record caches or opening databases, Oracle Corporation recommends that you increase the GLX_SHM_REG parameter by 2 times the sum of the number of row caches and number of databases that might be accessed in the Galaxy at one time. As the Galaxy shared memory region structures are not very large, setting this parameter to a higher than required value does not consume a significant amount of physical memory. It also may avoid a later reboot of the Galaxy environment. This parameter must be set on all nodes in the Galaxy.

Galaxy Reboot Required

Changing the GLX_SHM_REG system parameter requires that the OpenVMS Galaxy environment be booted from scratch. That is, all nodes in the Galaxy must be shut down and then the Galaxy reformed by starting each instance.

15.1.20 Oracle Rdb and OpenVMS ODS−5 Volumes

OpenVMS Version 7.2 introduced an Extended File Specifications feature, which consists of two major components:

- A new, optional, volume structure, ODS−5, which provides support for file names that are longer and have a greater range of legal characters than in previous versions of OpenVMS.
- Support for "deep" directory trees.

ODS−5 was introduced primarily to provide enhanced file sharing capabilities for users of Advanced Server for OpenVMS 7.2 (formerly known as PATHWORKS for OpenVMS), as well as DCOM and JAVA applications.

In some cases, Oracle Rdb performs its own file and directory name parsing and explicitly requires ODS−2 (the traditional OpenVMS volume structure) file and directory name conventions to be followed. Because of this knowledge, Oracle does not support any Oracle Rdb database file components (including root files, storage area files, after image journal files, record cache backing store files, database backup files, after image journal backup files, etc.) that utilize any non−ODS−2 file naming features. For this reason, Oracle recommends that Oracle Rdb database components not be located on ODS−5 volumes.

Oracle does support Oracle Rdb database file components on ODS−5 volumes provided that all of these files and directories used by Oracle Rdb strictly follow the ODS−2 file and directory name conventions. In particular, all file names must be specified entirely in uppercase and "special" characters in file or directory names are forbidden.

15.1.21 Optimization of Check Constraints

Bug 1448422

When phrasing constraints using the "CHECK" syntax, a poorer strategy can be chosen by the optimizer than when the same or similar constraint is phrased using referential integrity (PRIMARY and FOREIGN KEY) constraints.

For example, I have two tables T1 and T2, both with one column, and I wish to ensure that all values in table T1 exist in T2. Both tables have an index on the referenced field. I could use a PRIMARY KEY constraint on

T2 and a FOREIGN KEY constraint on T1.

```
SQL> alter table t2 alter column f2 primary key not deferrable;
SQL> alter table t1 alter column f1 references t2 not deferrable;
```

When deleting from the PRIMARY KEY table, Rdb will only check for rows in the FOREIGN KEY table where the FOREIGN KEY has the deleted value. This can be seen as an index lookup on T1 in the retrieval strategy.

```
SQL> delete from t2 where f2=1;
Get     Temporary relation      Retrieval by index of relation T2
  Index name  I2 [1:1]
Index only retrieval of relation T1
  Index name  I1 [1:1]
%RDB-E-INTEG_FAIL, violation of constraint T1_FOREIGN1 caused operation to fail
```

The failure of the constraint is not important. What is important is that Rdb efficiently detects that only those rows in T1 with the same values as the deleted row in T2 can be affected.

It is necessary sometimes to define this type of relationship using CHECK constraints. This could be necessary because the presence of NULL values in the table T2 precludes the definition of a primary key on that table. This could be done with a CHECK constraint of the form:

```
SQL> alter table t1 alter column f1
cont>   check (f1 in (select * from t2)) not deferrable;
SQL> delete from t2 where f2=1;
Get     Temporary relation      Retrieval by index of relation T2
  Index name  I2 [1:1]
Cross block of 2 entries
  Cross block entry 1
    Index only retrieval of relation T1
      Index name  I1 [0:0]
  Cross block entry 2
    Conjunct        Aggregate-F1    Conjunct
    Index only retrieval of relation T2
      Index name  I2 [0:0]
%RDB-E-INTEG_FAIL, violation of constraint T1_CHECK1 caused operation to fail
```

The cross block is for the constraint evaluation. This retrieval strategy indicates that to evaluate the constraint, the entire index on table T1 is being scanned and for each key, the entire index in table T2 is being scanned. The behavior can be improved somewhat by using an equality join condition in the select clause of the constraint:

```
SQL> alter table t1 alter column f1
cont>   check (f1 in (select * from t2 where f2=f1)) not deferrable;

or:

SQL> alter table t1 alter column f1
cont>   check (f1=(select * from t2 where f2=f1)) not deferrable;
```

In both cases the retrieval strategy will look like this:

```
SQL> delete from t2 where f2=1;
Get     Temporary relation      Retrieval by index of relation T2
  Index name  I2 [1:1]
Cross block of 2 entries
```

```
  Cross block entry 1
    Index only retrieval of relation T1
      Index name  I1 [0:0]
  Cross block entry 2
    Conjunct        Aggregate-F1    Conjunct
    Index only retrieval of relation T2
      Index name  I2 [1:1]
%RDB-E-INTEG_FAIL, violation of constraint T1_CHECK1 caused operation to fail
```

While the entire T1 index is scanned, at least the value from T1 is used to perform an index lookup on T2.

These restrictions result from semantic differences in the behavior of the "IN" and "EXISTS" operators with respect to null handling, and the complexity of dealing with non−equality join conditions.

To improve the performance of this type of integrity check on larger tables, it is possible to use a series of triggers to perform the constraint check. The following triggers perform a similar check to the constraints above.

```
SQL> create trigger t1_insert after insert on t1
cont>  when (not exists (select * from t2 where f2=f1))
cont>    (error) for each row;
SQL> create trigger t1_update after update on t1
cont>  when (not exists (select * from t2 where f2=f1))
cont>    (error) for each row;
SQL> ! A delete trigger is not needed on T1.
SQL> create trigger t2_delete before delete on t2
cont>  when (exists (select * from t1 where f1=f2))
cont>    (error) for each row;
SQL> create trigger t2_modify after update on t2
cont>  referencing old as t2o new as t2n
cont>  when (exists (select * from t1 where f1=t2o.f2))
cont>    (error) for each row;
SQL> ! An insert trigger is not needed on T2.
```

The strategy for a delete on T2 is now:

```
SQL> delete from t2 where f2=1;
Aggregate-F1    Index only retrieval of relation T1
  Index name  I1 [1:1]
Temporary relation      Get     Retrieval by index of relation T2
  Index name  I2 [1:1]
%RDB-E-TRIG_INV_UPD, invalid update; encountered error condition defined for
trigger
-RDMS-E-TRIG_ERROR, trigger T2_DELETE forced an error
```

The trigger strategy is the index only retrieval displayed first. You will note that the index on T1 is used to examine only those rows that may be affected by the delete.

Care must be taken when using this workaround as there are semantic differences in the operation of the triggers, the use of "IN" and "EXISTS", and the use of referential integrity constraints.

This workaround is useful where the form of the constraint is more complex, and cannot be phrased using referential integrity constraints. For example, if the application is such that the value in table T1 may be spaces or NULL to indicate the absence of a value, the above triggers could easily be modified to allow for these semantics.

15.1.22 Carryover Locks and NOWAIT Transaction Clarification

In NOWAIT transactions, the BLAST (Blocking AST) mechanism cannot be used. For the blocking user to receive the BLAST signal, the requesting user must request the locked resource with WAIT (which a NOWAIT transaction does not do). Oracle Rdb defines a resource called NOWAIT, which is used to indicate that a NOWAIT transaction has been started. When a NOWAIT transaction starts, the user requests the NOWAIT resource. All other database users hold a lock on the NOWAIT resource so that when the NOWAIT transaction starts, all other users are notified with a NOWAIT BLAST. The BLAST causes blocking users to release any carryover locks. There can be a delay before the transactions with carryover locks detect the presence of the NOWAIT transaction and release their carryover locks. You can detect this condition by examining the stall messages. If the "Waiting for NOWAIT signal (CW)" stall message appears frequently, the application is probably experiencing a decrease in performance, and you should consider disabling the carryover lock behavior.

15.1.23 Unexpected Results Occur During Read−Only Transactions on a Hot Standby Database

When using Hot Standby, it is typical to use the standby database for reporting, simple queries, and other read−only transactions. If you are performing these types of read−only transactions on a standby database, be sure you can tolerate a READ COMMIT level of isolation. This is because the Hot Standby database might be updated by another transaction before the read−only transaction finishes, and the data retrieved might not be what you expected.

Because Hot Standby does not write to the snapshot files, the isolation level achieved on the standby database for any read−only transaction is a READ COMMITED transaction. This means that nonrepeatable reads and phantom reads are allowed during the read−only transaction:

- Nonrepeatable read operations: Allows the return of different results within a single transaction when an SQL operation reads the same row in a table twice. Nonrepeatable reads can occur when another transaction modifies and commits a change to the row between transactions. Because the standby database will update the data when it confirms a transaction has been committed, it is very possible to see an SQL operation on a standby database return different results.
- Phantom read operations: Allows the return of different results within a single transaction when an SQL operation retrieves a range of data values (or similar data existence check) twice. Phantoms can occur if another transaction inserted a new record and committed the insertion between executions of the range retrieval. Again, because the standby database may do this, phantom reads are possible.

Thus, you cannot rely on any data read from the standby database to remain unchanged. Be sure your read−only transactions can tolerate a READ COMMIT level of isolation before you implement procedures that read and use data from a standby database.

15.1.24 Row Cache Not Allowed While Hot Standby Replication is Active

The row cache feature may not be enabled on a hot standby database while replication is active. The hot standby feature will not start if row cache is enabled.

This restriction exists because rows in the row cache are accessed via logical dbkeys. However, information transferred to the standby database via the after image journal facility only contains physical dbkeys. Because there is no way to maintain rows in the cache via the hot standby processing, the row cache must be disabled when the standby database is open and replication is active.

A new command qualifier, ROW_CACHE=DISABLED, has been added to the RMU Open command. To open the hot standby database prior to starting replication, use the ROW_CACHE=DISABLED qualifier on the RMU Open command.

15.1.25 Excessive Process Page Faults and Other Performance Considerations During Oracle Rdb Sorts

Excessive hard or soft page faulting can be a limiting factor of process performance. One factor contributing to Oracle Rdb process page faulting is sorting operations. Common causes of sorts include the SQL GROUP BY, ORDER BY, UNION, and DISTINCT clauses specified for a query, and index creation operations. Defining the logical name RDMS$DEBUG_FLAGS to "RS" can help determine when Oracle Rdb sort operations are occurring and to display the sort keys and statistics.

Oracle Rdb includes its own copy of the OpenVMS SORT32 code within the Oracle Rdb images and does not generally call the routines in the OpenVMS run−time library. A copy of the SORT32 code is used to provide stability between versions of Oracle Rdb and OpenVMS and because Oracle Rdb calls the sort routines from executive processor mode which is difficult to do using the SORT32 shareable image. SQL IMPORT and RMU Load operations do, however, call the OpenVMS SORT run−time library.

At the beginning of a sort operation, the SORT code allocates memory for working space. The SORT code uses this space for buffers, in−memory copies of the data, and sorting trees.

SORT does not directly consider the processes quotas or parameters when allocating memory. The effects of WSQUOTA and WSEXTENT are indirect. At the beginning of each sort operation, the SORT code attempts to adjust the process working set to the maximum possible size using the $ADJWSL system service specifying a requested working set limit of %X7FFFFFFF pages (the maximum possible). SORT then uses a value of 75% of the returned working set for virtual memory scratch space. The scratch space is then initialized and the sort begins.

The initialization of the scratch space generally causes page faults to access the pages newly added to the working set. Pages that were in the working set already may be faulted out as the new pages are faulted in. Once the sort operation completes and SORT returns back to Oracle Rdb, the pages that may have been faulted out of the working set are likely to be faulted back into the working set.

When a process working set is limited by the working set quota (WSQUOTA) parameter and the working set extent (WSEXTENT) parameter is a much larger value, the first call to the sort routines can cause many page faults as the working set grows. Using a value of WSEXTENT that is closer to WSQUOTA can help reduce the impact of this case.

With some OpenVMS versions, AUTOGEN sets the SYSGEN parameter PQL_MWSEXTENT equal to the WSMAX parameter. This means that all processes on the system end up with WSEXTENT the same as WSMAX. Since that might be quite high, sorting might result in excessive page faulting. You may want to explicitly set PQL_MWSEXTENT to a lower value if this is the case on your system.

Sort work files are another factor to consider when tuning for Oracle Rdb sort operations. When the operation can not be done in the available memory, SORT uses temporary disk files to hold the data as it is being sorted. The Oracle Rdb7 Guide to Database Performance and Tuning contains more detailed information about sort work files.

The logical name RDMS$BIND_SORT_WORKFILES specifies how many work files sort is to use if work files are required. The default is 2 and the maximum number is 36. The work files can be individually controlled by the SORTWORKn logical names (where n ranges from "0" through "Z"). You can increase the efficiency of sort operations by assigning the location of the temporary sort work files to different disks. These assignments are made by using up to 36 logical names, "SORTWORK0" through "SORTWORKZ".

Normally, SORT places work files in the your SYS$SCRATCH directory. By default, SYS$SCRATCH is the same device and directory as the SYS$LOGIN location. Spreading the I/O load over multiple disks and/or controllers improves efficiency as well as performance by taking advantage of more system resources and helps prevent disk I/O bottlenecks. Specifying that a your work files reside on separate disks permits overlap of the SORT read/write cycle. You may also encounter cases where insufficient space exists on the SYS$SCRATCH disk device (for example, while Oracle Rdb builds indexes for a very large table). Using the "SORTWORK0" through "SORTWORKZ" logical names can help you avoid this problem.

Note that SORT uses the work files for different sorted runs, and then merges the sorted runs into larger groups. If the source data is mostly sorted, then not every sort work file may need to be accessed. This is a possible source of confusion because even with 36 sort work files, it is possible to exceed the capacity of the first SORT file device and the sort operation fails never having accessed the remaining 35 sort work files.

At this time, more than 10 sort work files will only be used by the Oracle Rdb sort interface as used by the CREATE INDEX, ALTER INDEX and the clauses UNION DISTINCT, ORDER BY, GROUP BY and SELECT DISTINCT. The RMU and SQL IMPORT interfaces use the OpenVMS SORT interface which does not currently support more than 10 sort work files.

Note that the logical names RDMS$BIND_WORK_VM and RDMS$BIND_WORK_FILE do not affect or control the operation of sort. These logical names are used to control other temporary space allocation within Oracle Rdb.

15.1.26 Control of Sort Work Memory Allocation

Oracle Rdb uses a built−in SORT32 package to perform many sort operations. Sometimes, these sorts exhibit a significant performance problem when initializing work memory to be used for the sort. This behavior can be experienced, for example, when a very large sort cardinality is estimated, but the actual sort cardinality is small.

In rare cases, it may be desirable to artificially limit the sort package's use of work memory. Two logicals have been created to allow this control. In general, there should be no need to use either of these logicals and misuse of them can significantly impact sort performance. Oracle recommends that these logicals be used carefully and sparingly.

The logical names are:

Table 15−1 Sort Memory Logicals

Logical	Definition
RDMS$BIND_SORT_MEMORY_WS_FACTOR	Specifies a percentage of the process's working set limit to be used when allocating sort memory for the built−in SORT32 package. If not defined, the default value is 75 (representing 75%), the maximum value is 75 (representing 75%), and the minimum value is 2 (representing 2%). Processes with vary large working set limits can sometimes experience significant page faulting and CPU consumption while initializing sort memory. This logical name can restrict the sort work memory to a percentage of the processes maximum working set.
RDMS$BIND_SORT_MEMORY_MAX_BYTES	Specifies an absolute limit to be used when allocating sort memory for the built−in SORT32 package. If not defined, the default value is unlimited (up to 1GB), the maximum value is 2147483647 and the minimum value is 32768.

15.1.27 The Halloween Problem

When a cursor is processing rows selected from a table, it is possible that another separate query can interfere with the retrieval of the cursor by modifying the index columns key values used by the cursor.

For instance, if a cursor selects all EMPLOYEES with LAST_NAME >= 'M', it is likely that the query will use the sorted index on LAST_NAME to retrieve the rows for the cursor. If an update occurs during the processing of the cursor which changes the LAST_NAME of an employee from "Mason" to "Rickard", then it is possible that that employee row will be processed twice. First when it is fetched with name "Mason", and then later when it is accessed by the new name "Rickard".

The Halloween problem is a well known problem in relational databases. Access strategies which optimize the I/O requirements, such as Index Retrieval, can be subject to this problem. Interference from queries by other sessions are avoided by locking and are controlled by the ISOLATION LEVEL options in SQL, or the CONCURRENCY/CONSISTENCY options in RDO/RDML.

Oracle Rdb avoids this problem if it knows that the cursors subject table will be updated. For example, if the SQL syntax UPDATE ... WHERE CURRENT OF is used to perform updates of target rows, or the RDO/RDML MODIFY statement uses the context variable for the stream. Then the optimizer will choose an alternate access strategy if an update can occur which may cause the Halloween problem. This can be seen in the access strategy in Example 2−2 as a "Temporary relation" being created to hold the result of the cursor query.

When you use interactive or dynamic SQL, the UPDATE ... WHERE CURRENT OF or DELETE ... WHERE CURRENT OF statements will not be seen until after the cursor is declared and opened. In these environments, you must use the FOR UPDATE clause to specify that columns selected by the cursor will be updated during cursor processing. This is an indication to the Rdb optimizer so that it protects against the Halloween problem in this case. This is shown in Example 2−1 and Example 2−2.

The following example shows that the EMP_LAST_NAME index is used for retrieval. Any update performed will possibly be subject to the Halloween problem.

```
SQL> set flags 'strategy';
SQL> declare emp  cursor for
cont> select * from employees where last_name >= 'M' order by last_name;
SQL> open emp;
Conjunct        Get     Retrieval by index of relation EMPLOYEES
  Index name  EMP_LAST_NAME [1:0]
SQL> close emp;
```

The following example shows that the query specifies that the column LAST_NAME will be updated by some later query. Now the optimizer protects the EMP_LAST_NAME index used for retrieval by using a "Temporary Relation" to hold the query result set. Any update performed on LAST_NAME will now avoid the Halloween problem.

```
SQL> set flags 'strategy';
SQL> declare emp2 cursor for
cont> select * from employees where last_name >= 'M'
cont> order by last_name for update of last_name;
SQL> open emp2;
Temporary relation      Conjunct        Get
Retrieval by index of relation EMPLOYEES
  Index name  EMP_LAST_NAME [1:0]
SQL> close emp2;
```

When you use the SQL precompiler, or the SQL module language compiler it can be determined from usage that the cursor context will possibly be updated during the processing of the cursor because all cursor related statements are present within the module. This is also true for the RDML/RDBPRE precompilers when you use the DECLARE_STREAM and START_STREAM statements and use the same stream context to perform all MODIFY and ERASE statements.

The point to note here is that the protection takes place during the open of the SQL cursor (or RDO stream), not during the subsequent UPDATE or DELETE.

If you execute a separate UPDATE query which modifies rows being fetched from the cursor then the actual rows fetched will depend upon the access strategy chosen by the Rdb optimizer. As the query is separate from the cursors query (i.e. doesn't reference the cursor context), then the optimizer does not know that the cursor selected rows are potentially updated and so cannot perform the normal protection against the Halloween problem.

15.2 SQL Known Problems and Restrictions

This section describes known problems and restrictions for the SQL interface.

15.2.1 SET FLAGS CRONO_FLAG Removed

The SET FLAGS statement and RDMS$SET_FLAGS logical name no longer accept the obsolete keyword CRONO_FLAG. This keyword has been removed. Please update all scripts and applications to use the keyword CHRONO_FLAG.

15.2.2 Interchange File (RBR) Created by Oracle Rdb Release 7.2 Not Compatible With Previous Releases

To support the large number of new database attributes and objects, the protocol used by SQL EXPORT and SQL IMPORT has been enhanced to support more protocol types. Therefore, this format of the Oracle Rdb release 7.2 interchange files can no longer be read by older versions of Oracle Rdb.

Oracle Rdb continues to provide upward compatibility for interchange files generated by older versions.

Oracle Rdb has never supported backward compatibility, however, it was sometimes possible to use an interchange file with an older version of IMPORT. However, this protocol change will no longer permit this usage.

15.2.3 Single Statement LOCK TABLE is Not Supported for SQL Module Language and SQL Precompiler

The new LOCK TABLE statement is not currently supported as a single statement within the module language or embedded SQL language compiler.

Instead you must enclose the statement in a compound statement. That is, use BEGIN... END around the statement as shown in the following example. This format provides all the syntax and flexibility of LOCK TABLE.

This restriction does not apply to interactive or dynamic SQL.

The following extract from the module language listing file shows the reported error if you use LOCK TABLE as a single statement procedure. The other procedure in the same module is acceptable because it uses a compound statement that contains the LOCK TABLE statement.

```
1 MODULE sample_test
2 LANGUAGE C
3 PARAMETER COLONS
4
5 DECLARE ALIAS FILENAME 'mf_personnel'
6
7 PROCEDURE a (SQLCODE);
8 LOCK TABLE employees FOR EXCLUSIVE WRITE MODE;
%SQL-F-WISH_LIST, (1) Feature not yet implemented - LOCK TABLE requires compound
statement
```

```
9
10 PROCEDURE b (SQLCODE);
11 BEGIN
12 LOCK TABLE employees FOR EXCLUSIVE WRITE MODE;
13 END;
```

To workaround this problem of using LOCK TABLE for SQL module language or embedded SQL application, use a compound statement in an EXEC SQL statement.

15.2.4 Multistatement or Stored Procedures May Cause Hangs

Long−running multistatement or stored procedures can cause other users in the database to hang if the procedures obtain resources needed by those other users. Some resources obtained by the execution of a multistatement or stored procedure are not released until the multistatement or stored procedure finishes. Thus, any−long running multistatement or stored procedure can cause other processes to hang. This problem can be encountered even if the statement contains SQL COMMIT or ROLLBACK statements.

The following example demonstrates the problem. The first session enters an endless loop; the second session attempts to backup the database but hangs forever.

```
Session 1:

SQL> attach 'filename MF_PERSONNEL';
SQL> create function LIB$WAIT (in real by reference)
cont> returns integer;
cont> external name LIB$WAIT location 'SYS$SHARE:LIBRTL.EXE'
cont> language general general parameter style variant;
SQL> commit;
        .
        .
        .
$ SQL
SQL> attach 'filename MF_PERSONNEL';
SQL> begin
cont> declare :LAST_NAME LAST_NAME_DOM;
cont> declare :WAIT_STATUS integer;
cont> loop
cont> select LAST_NAME into :LAST_NAME
cont> from EMPLOYEES where EMPLOYEE_ID = '00164';
cont> rollback;
cont> set :WAIT_STATUS = LIBWAIT (5.0);
cont> set transaction read only;
cont> end loop;
cont> end;

Session 2:

$ RMU/BACKUP/LOG/ONLINE MF_PERSONNEL MF_PERSONNEL

From a third session, you can see that the backup process is waiting for a lock
held in the first session:

$ RMU/SHOW LOCKS /MODE=BLOCKING MF_PERSONNEL
    .
    .
    .
```

```
Resource: nowait signal

ProcessID Process Name        Lock ID  System ID Requested Granted
--------- ---------------     -------- -------- --------- -------
20204383  RMU BACKUP.....     5600A476  00010001 CW        NL
2020437B  SQL............     3B00A35C  00010001 PR        PR
```

There is no workaround for this restriction. When the multistatement or stored procedure finishes execution, the resources needed by other processes are released.

15.2.5 Use of Oracle Rdb from Shareable Images

If code in the image initialization routine of a shareable image makes any calls into Oracle Rdb, through SQL or any other means, access violations or other unexpected behavior may occur if Oracle Rdb images have not had a chance to do their own initialization.

To avoid this problem, applications must take one of the following steps:

- Do not make Oracle Rdb calls from the initialization routines of shareable images.
- Link in such a way that the RDBSHR.EXE image initializes first. You can do this by placing the reference to RDBSHR.EXE and any other Oracle Rdb shareable images last in the linker options file.

This is not a bug; it is a restriction resulting from the way OpenVMS image activation works.

15.3 Oracle RMU Known Problems and Restrictions

This section describes known problems and restrictions for the RMU interface.

15.3.1 RMU Convert Fails When Maximum Relation ID is Exceeded

If, when relation IDs are assigned to new system tables during an RMU Convert to a V7.2 database, the maximum relation ID of 8192 allowed by Oracle Rdb is exceeded, the fatal error %RMU−F−RELMAXIDBAD is displayed and the database is rolled back to the prior database version. Contact your Oracle support representative if you get this error. Note that when the database is rolled back, the fatal error %RMU−F−CVTROLSUC is displayed to indicate that the rollback was successful but caused by the detection of a fatal error and not requested by the user.

This condition only occurs if there are an extremely large number of tables defined in the database or if a large number of tables were defined but have subsequently been deleted.

The following example shows both the %RMU−F−RELMAXIDBAD error message if the allowed database relation ID maximum of 8192 is exceeded and the %RMU−F−CVTROLSUC error message when the database has been rolled back to V7.0 since it cannot be converted to V7.2:

```
$rmu/convert mf_personnel
%RMU−I−RMUTXT_000, Executing RMU for Oracle Rdb V7.2
Are you satisfied with your backup of
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 and your backup of
 any associated .aij files [N]? Y
 %RMU−I−LOGCONVRT, database root converted to current structure level
 %RMU−F−RELMAXIDBAD, ROLLING BACK CONVERSION − Relation ID exceeds maximum
  8192 for system table RDB$RELATIONS
 %RMU−F−CVTROLSUC, CONVERT rolled−back for
  DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 to version V7.0
```

The following example shows the normal case when the maximum allowed relation ID is not exceeded:

```
$rmu/convert mf_personnel
%RMU−I−RMUTXT_000, Executing RMU for Oracle Rdb V7.2
Are you satisfied with your backup of
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 and your backup of
 any associated .aij files [N]? Y
%RMU−I−LOGCONVRT, database root converted to current structure level
%RMU−S−CVTDBSUC, database DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
 successfully converted from version V7.0 to V7.2
%RMU−I−CVTCOMSUC, CONVERT committed for
 DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1 to version V7.2
```

15.3.2 RMU Unload /After_Journal Requires Accurate AIP Logical Area Information

The RMU Unload /After_Journal command uses the on−disk area inventory pages (AIPs) to determine the appropriate type of each logical area when reconstructing logical dbkeys for records stored in mixed−format storage areas. However, the logical area type information in the AIP is generally unknown for logical areas created prior to Oracle Rdb release 7.0.1. If the RMU Unload /After_Journal command cannot determine the logical area type for one or more AIP entries, a warning message is displayed for each such area and may ultimately return logical dbkeys with a 0 (zero) area number for records stored in mixed−format storage areas.

In order to update the on−disk logical area type in the AIP, the RMU Repair utility must be used. The INITIALIZE=LAREA_PARAMETERS=optionfile qualifier option file can be used with the TYPE qualifier. For example, to repair the EMPLOYEES table of the MF_PERSONNEL database, you would create an options file that contains the following line:

EMPLOYEES /TYPE=TABLE

For partitioned logical areas, the AREA=name qualifier can be used to identify the specific storage areas that are to be updated. For example, to repair the EMPLOYEES table of the MF_PERSONNEL database for the EMPID_OVER storage area only, you would create an options file that contains the following line:

EMPLOYEES /AREA=EMPID_OVER /TYPE=TABLE

The TYPE qualifier specifies the type of a logical area. The following keywords are allowed:

- TABLE
  Specifies that the logical area is a data table. This would be a table created using the SQL CREATE TABLE syntax.
- B−TREE
  Specifies that the logical area is a B−tree index. This would be an index created using the SQL CREATE INDEX TYPE IS SORTED syntax.
- HASH
  Specifies that the logical area is a hash index. This would be an index created using the SQL CREATE INDEX TYPE IS HASHED syntax.
- SYSTEM
  Specifies that the logical area is a system record that is used to identify hash buckets. Users cannot explicitly create these types of logical areas.

  Note

  This type should NOT be used for the RDB$SYSTEM logical areas. This type does NOT identify system relations.

- BLOB
  Specifies that the logical area is a BLOB repository.

There is no explicit error checking of the type specified for a logical area. However, an incorrect type may cause the RMU Unload /After_Journal command to be unable to correctly return valid, logical dbkeys.

15.3.3 Do Not Use HYPERSORT with RMU Optimize After_Journal Command

The OpenVMS Alpha V7.1 operating system introduced the high−performance Sort/Merge utility (also known as HYPERSORT). This utility takes advantage of the OpenVMS Alpha architecture to provide better performance for most sort and merge operations.

The high−performance Sort/Merge utility supports a subset of the SOR routines. Unfortunately, the high−performance Sort/Merge utility does not support several of the interfaces used by the RMU Optimize After_Journal command. In addition, the high−performance Sort/Merge utility reports no error or warning when being called with the unsupported options used by the RMU Optimize After_Journal command.

Because of this, the use of the high−performance Sort/Merge utility is not supported for the RMU Optimize After_Journal command. Do not define the logical name SORTSHR to reference HYPERSORT.EXE.

15.3.4 Changes in EXCLUDE and INCLUDE Qualifiers for RMU Backup

The RMU Backup command no longer accepts both the Include and Exclude qualifiers in the same command. This change removes the confusion over exactly what gets backed up when Include and Exclude are specified on the same line, but does not diminish the capabilities of the RMU Backup command.

To explicitly exclude some storage areas from a backup, use the Exclude qualifier to name the storage areas to be excluded. This causes all storage areas to be backed up except for those named by the Exclude qualifier.

Similarly, the Include qualifier causes only those storage areas named by the qualifier to be backed up. Any storage area not named by the Include qualifier is not backed up. The Noread_only and Noworm qualifiers continue to cause read−only storage areas and WORM storage areas to be omitted from the backup even if these areas are explicitly listed by the Include qualifier.

Another related change is in the behavior of EXCLUDE=*. In previous versions, EXCLUDE=* caused all storage areas to be backed up. Beginning with V7.1, EXCLUDE=* causes only a root backup to be done. A backup created by using EXCLUDE=* can be used only by the RMU Restore Only_Root command.

15.3.5 RMU Backup Operations Should Use Only One Type of Tape Drive

When using more than one tape drive for an RMU Backup command, all of the tape drives must be of the same type (for example, all the tape drives must be TA90s or TZ87s or TK50s). Using different tape drive types (for example, one TK50 and one TA90) for a single database backup operation may make database restoration difficult or impossible.

Oracle RMU attempts to prevent using different tape drive densities during a backup operation, but is not able to detect all invalid cases and expects that all tape drives for a backup are of the same type.

As long as all of the tapes used during a backup operation can be read by the same type of tape drive during a restore operation, the backup is likely valid. This may be the case, for example, when using a TA90 and a TA90E.

Oracle Corporation recommends that, on a regular basis, you test your backup and recovery procedures and environment using a test system. You should restore the database and then recover using AIJs to simulate failure recovery of the production system.

Consult the Oracle Rdb7 Guide to Database Maintenance, the Oracle Rdb7 Guide to Database Design and Definition, and the Oracle RMU Reference Manual for additional information about Oracle Rdb backup and restore operations.

15.3.6 RMU/VERIFY Reports PGSPAMENT or PGSPMCLST Errors

RMU/VERIFY may sometimes report PGSPAMENT or PGSPMCLST errors when verifying storage areas. These errors indicate that the Space Area Management (SPAM) page fullness threshold for a particular data page does not match the actual space usage on the data page. For a further discussion of SPAM pages, consult the Oracle Rdb7 Guide to Database Maintenance.

In general, these errors will not cause any adverse affect on the operation of the database. There is potential for space on the data page to not be totally utilized, or for a small amount of extra I/O to be expended when searching for space in which to store new rows. But unless there are many of these errors then the impact should be negligible.

It is possible for these inconsistencies to be introduced by errors in Oracle Rdb. When those cases are discovered, Oracle Rdb is corrected to prevent the introduction of the inconsistencies. It is also possible for these errors to be introduced during the normal operation of Oracle Rdb. The following scenario can leave the SPAM pages inconsistent:

1. A process inserts a row on a page, and updates the threshold entry on the corresponding SPAM page to reflect the new space utilization of the data page. The data page and SPAM pages are not flushed to disk.
2. Another process notifies the first process that it would like to access the SPAM page being held by the process. The first process flushes the SPAM page changes to disk and releases the page. Note that it has not flushed the data page.
3. The first process then terminates abnormally (for example, from the DCL STOP/IDENTIFICATION command). Since that process never flushed the data page to disk, it never wrote the changes to the Recovery Unit Journal (RUJ) file. Since there were no changes in the RUJ file for that data page then the Database Recovery (DBR) process did not need to roll back any changes to the page. The SPAM page retains the threshold update change made above even though the data page was never flushed to disk.

While it would be possible to create mechanisms to ensure that SPAM pages do not become out of synch with their corresponding data pages, the performance impact would not be trivial. Since these errors are relatively rare and the impact is not significant, then the introduction of these errors is considered to be part of the normal operation of Oracle Rdb. If it can be proven that the errors are not due to the scenario above, then Oracle Product Support should be contacted.

PGSPAMENT and PGSPMCLST errors may be corrected by doing any one of the following operations:

- Recreate the database by performing:
    1. SQL EXPORT
    2. SQL DROP DATABASE
    3. SQL IMPORT
- Recreate the database by performing:
    1. RMU/BACKUP
    2. SQL DROP DATABASE

3. RMU/RESTORE

- Repair the SPAM pages by using the RMU/REPAIR command. Note that the RMU/REPAIR command does not write its changes to an after−image journal (AIJ) file. Therefore, Oracle recommends that a full database backup be performed immediately after using the RMU/REPAIR command.

15.4 Known Problems and Restrictions in All Interfaces for Release 7.0 and Earlier

The following problems and restrictions from release 7.0 and earlier still exist.

15.4.1 Converting Single−File Databases

Because of a substantial increase in the database root file information for V7.0, you should ensure that you have adequate disk space before you use the RMU Convert command with single−file databases and V7.0 or higher.

The size of the database root file of any given database increases a maximum of about 600 disk blocks. The actual increase depends mostly on the maximum number of users specified for the database.

15.4.2 Row Caches and Exclusive Access

If a table has a row−level cache defined for it, the Row Cache Server (RCS) may acquire a shared lock on the table and prevent any other user from acquiring a Protective or Exclusive lock on that table.

15.4.3 Exclusive Access Transactions May Deadlock with RCS Process

If a table is frequently accessed by long running transactions that request READ/WRITE access reserving the table for EXCLUSIVE WRITE and if the table has one or more indexes, you may experience deadlocks between the user process and the Row Cache Server (RCS) process.

There are at least three suggested workarounds to this problem:

- Reserve the table for SHARED WRITE
- Close the database and disable row cache for the duration of the exclusive transaction
- Change the checkpoint interval for the RCS process to a time longer than the time required to complete the batch job and then trigger a checkpoint just before the batch job starts. Set the interval back to a smaller interval after the checkpoint completes.

15.4.4 Strict Partitioning May Scan Extra Partitions

When you use a WHERE clause with the less than (<) or greater than (>) operator and a value that is the same as the boundary value of a storage map, Oracle Rdb scans extra partitions. A boundary value is a value specified in the WITH LIMIT OF clause. The following example illustrates the behavior:

```
SQL> create table T1
cont>     (id integer
cont>     ,last_name char(12)
cont>     ,first_name char(12)
cont>     );
SQL> create storage map M for T1
```

```
cont>     partitioning not updatable
cont>     store using (id)
cont>         in EMPIDS_LOW with limit of (200)
cont>         in EMPIDS_MID with limit of (400)
cont>         otherwise in EMPIDS_OVER;
SQL> insert into T1 values (150,'Boney','MaryJean');
1 row inserted
SQL> insert into T1 values (350,'Morley','Steven');
1 row inserted
SQL> insert into T1 values (300,'Martinez','Nancy');
1 row inserted
SQL> insert into T1 values (450,'Gentile','Russ');
1 row inserted
SQL>
SQL> set flags 'EXECUTION(100),STRATEGY,DETAIL(2),INDEX_PARTITIONS';
SQL>
SQL> select * from T1 where ID > 400;
~S#0001
Tables:
  0 = T1
Conjunct: 0.ID > 400
Get     Retrieval sequentially of relation 0:T1         (partitioned scan#1)
~E#0001.1: Strict Partitioning using 2 areas
    partition 2 (larea=60) "EMPIDS_MID"
    partition 3 (larea=61) "EMPIDS_OVER" otherwise
          ID   LAST_NAME      FIRST_NAME
         450   Gentile        Russ
1 row selected
SQL>
```

In this example, partition 2 does not need to be scanned but is still accessed due to the structure of the generated key values. This does not affect the correctness of the result. Users can avoid the extra scan by using values other than the boundary values.

15.4.5 Restriction When Adding Storage Areas with Users Attached to Database

If you try to interactively add a new storage area where the page size is less than the smallest existing page size and the database has been manually opened or users are active, the add operation fails with the following errors:

```
%RDMS-F-NOEUACCESS, unable to acquire exclusive access to database
```

or

```
%RDB-F-SYS_REQUEST, error from system services request
-RDMS-F-FILACCERR, error opening database root DKA0:[RDB]TEST.RDB;1
-SYSTEM-W-ACCONFLICT, file access conflict
```

You can make this change only when no users are attached to the database and, if the database is set to OPEN IS MANUAL, the database is closed. Several internal Oracle Rdb data structures are based on the minimum page size and these structures cannot be resized if users are attached to the database.

Furthermore, because this particular change is not recorded in the AIJ, any recovery scenario fails. Note also that if you use .aij files, you must backup the database and restart after-image journaling because this change invalidates the current AIJ recovery.

15.4.6 Multiblock Page Writes May Require Restore Operation

If a node fails while a multiblock page is being written to disk, the page in the disk becomes inconsistent, and is detected immediately during failover. (Failover is the recovery of an application by restarting it on another computer.) The problem is rare, and occurs because only single−block I/O operations are guaranteed by OpenVMS to be written atomically. This problem has never been reported by any customer and was detected only during stress tests in our labs.

Correct the page by an area−level restore operation. Database integrity is not compromised, but the affected area is not available until the restore operation completes.

A future release of Oracle Rdb will provide a solution that guarantees multiblock atomic write operations. Cluster failovers will automatically cause the recovery of multiblock pages, and no manual intervention will be required.

15.4.7 Replication Option Copy Processes Do Not Process Database Pages Ahead of an Application

When a group of copy processes initiated by the Replication Option (formerly Data Distributor) begins running after an application has begun modifying the database, the copy processes catch up to the application and are not able to process database pages that are logically ahead of the application in the RDB$CHANGES system relation. The copy processes all align waiting for the same database page and do not move on until the application has released it. The performance of each copy process degrades because it is being paced by the application.

When a copy process completes updates to its respective remote database, it updates the RDB$TRANSFERS system relation and then tries to delete any RDB$CHANGES rows not needed by any transfers. During this process, the RDB$CHANGES table cannot be updated by any application process, holding up any database updates until the deletion process is complete. The application stalls while waiting for the RDB$CHANGES table. The resulting contention for RDB$CHANGES SPAM pages and data pages severely impacts performance throughput, requiring user intervention with normal processing.

This is a known restriction in V4.0 and higher. Oracle Rdb uses page locks as latches. These latches are held only for the duration of an action on the page and not to the end of transaction. The page locks also have blocking asynchronous system traps (ASTs) associated with them. Therefore, whenever a process requests a page lock, the process holding that page lock is sent a blocking AST (BLAST) by OpenVMS. The process that receives such a blocking AST queues the fact that the page lock should be released as soon as possible. However, the page lock cannot be released immediately.

Such work requests to release page locks are handled at verb commit time. An Oracle Rdb verb is an Oracle Rdb query that executes atomically, within a transaction. Therefore, verbs that require the scan of a large table, for example, can be quite long. An updating application does not release page locks until its verb has completed.

The reasons for holding on to the page locks until the end of the verb are fundamental to the database management system.

15.5 SQL Known Problems and Restrictions for Oracle Rdb Release 7.0 and Earlier

The following problems and restrictions from Oracle Rdb Release 7.0 and earlier still exist.

15.5.1 ARITH_EXCEPT or Incorrect Results Using LIKE IGNORE CASE

When you use LIKE...IGNORE CASE, programs linked under Oracle Rdb V4.2 and V5.1, but run under higher versions of Oracle Rdb, may result in incorrect results or %RDB−E−ARITH_EXCEPT exceptions.

To work around the problem, avoid using IGNORE CASE with LIKE or recompile and relink under a higher version (V6.0 or higher.)

15.5.2 Different Methods of Limiting Returned Rows from Queries

You can establish the query governor for rows returned from a query by using either the SQL SET QUERY LIMIT statement or a logical name. This note describes the differences between the two mechanisms.

If you define the RDMS$BIND_QG_REC_LIMIT logical name to a small value, the query often fails with no rows returned regardless of the value assigned to the logical. The following example demonstrates setting the limit to 10 rows and the resulting failure:

```
$ DEFINE RDMS$BIND_QG_REC_LIMIT 10
$ SQL$
SQL> ATTACH 'FILENAME MF_PERSONNEL';
SQL> SELECT EMPLOYEE_ID FROM EMPLOYEES;
%RDB−F−EXQUOTA, Oracle Rdb runtime quota exceeded
−RDMS−E−MAXRECLIM, query governor maximum limit of rows has been reached
```

Interactive SQL must load its metadata cache for the table before it can process the SELECT statement. In this example, interactive SQL loads its metadata cache to allow it to check that the column EMPLOYEE_ID really exists for the table. The queries on the Oracle Rdb system relations RDB$RELATIONS and RDB$RELATION_FIELDS exceed the limit of rows.

Oracle Rdb does not prepare the SELECT statement, let alone execute it. Raising the limit to a number less than 100 (the cardinality of EMPLOYEES) but more than the number of columns in EMPLOYEES (that is, the number of rows to read from the RDB$RELATION_FIELDS system relation) is sufficient to read each column definition.

To see an indication of the queries executed against the system relations, define the RDMS$DEBUG_FLAGS logical name as "S" or "B".

If you set the row limit using the SQL SET QUERY statement and run the same query, it returns the number of rows specified by the SQL SET QUERY statement before failing:

```
SQL> ATTACH 'FILENAME MF_PERSONNEL';
SQL> SET QUERY LIMIT ROWS 10;
SQL> SELECT EMPLOYEE_ID FROM EMPLOYEES;
EMPLOYEE_ID
00164
00165
   .
   .
   .
00173
%RDB-E-EXQUOTA, Oracle Rdb runtime quota exceeded
-RDMS-E-MAXRECLIM, query governor maximum limit of rows has been reached
```

The SET QUERY LIMIT specifies that only user queries be limited to 10 rows. Therefore, the queries used to load the metadata cache are not restricted in any way.

Like the SET QUERY LIMIT statement, the SQL precompiler and module processor command line qualifiers (QUERY_MAX_ROWS and SQLOPTIONS=QUERY_MAX_ROWS) only limit user queries.

Keep the differences in mind when limiting returned rows using the logical name RDMS$BIND_QG_REC_LIMIT. They may limit more queries than are obvious. This is important when using 4GL tools, the SQL precompiler, the SQL module processor, and other interfaces that read the Oracle Rdb system relations as part of query processing.

15.5.3 Suggestions for Optimal Use of SHARED DATA DEFINITION Clause for Parallel Index Creation

The CREATE INDEX process involves the following steps:

1. Process the metadata.
2. Lock the index name.
   Because new metadata (which includes the index name) is not written to disk until the end of the index process, Oracle Rdb must ensure index name uniqueness across the database during this time by taking a special lock on the provided index name.
3. Read the table for sorting by selected index columns and ordering.
4. Sort the key data.
5. Build the index (includes partitioning across storage areas).
6. Write new metadata to disk.

Step 6 is the point of conflict with other index definers because the system relation and indexes are locked like any other updated table.

Multiple users can create indexes on the same table by using the RESERVING table_name FOR SHARED DATA DEFINITION clause of the SET TRANSACTION statement. For optimal usage of this capability, Oracle Rdb suggests the following guidelines:

- You should commit the transaction immediately after the CREATE INDEX statement so that locks on the table are released. This avoids lock conflicts with other index definers and improves overall concurrency.
- By assigning the location of the temporary sort work files SORTWORK0, SORTWORK1, ... , SORTWORK9 to different disks for each parallel process that issues the SHARED DATA DEFINITION statement, you can increase the efficiency of sort operations. This minimizes

any possible disk I/O bottlenecks and allows overlap of the SORT read/write cycle.

- If possible, enable global buffers and specify a buffer number large enough to hold a sufficient amount of table data. However, do not define global buffers larger than the available system physical memory. Global buffers allow sharing of database pages and thus result in disk I/O savings. That is, pages are read from disk by one of the processes and then shared by the other index definers for the same table, reducing the I/O load on the table.
- If global buffers are not used, ensure that enough local buffers exist to keep much of the index cached (use the RDM$BIND_BUFFERS logical name or the NUMBER OF BUFFERS IS clause in SQL to change the number of buffers).
- To distribute the disk I/O load, store the storage areas for the indexes on separate disk drives. Note that using the same storage area for multiple indexes results in contention during the index creation (Step 5) for SPAM pages.
- Consider placing the .ruj file for each parallel definer on its own disk or an infrequently used disk.
- Even though snapshot I/O should be minimal, consider disabling snapshots during parallel index creation.
- Refer to the Oracle Rdb7 Guide to Database Performance and Tuning to determine the appropriate working set values for each process to minimize excessive paging activity. In particular, avoid using working set parameters where the difference between WSQUOTA and WSEXTENT is large. The SORT utility uses the difference between these two values to allocate scratch virtual memory. A large difference (that is, the requested virtual memory grossly exceeds the available physical memory) may lead to excessive page faulting.
- The performance benefits of using SHARED DATA DEFINITION can best be observed when creating many indexes in parallel. The benefit is in the average elapsed time, not in CPU or I/O usage. For example, when two indexes are created in parallel using the SHARED DATA DEFINITION clause, the database must be attached twice, and the two attaches each use separate system resources.
- Using the SHARED DATA DEFINITION clause on a single−file database or for indexes defined in the RDB$SYSTEM storage area is not recommended.

The following table displays the elapsed time benefit when creating multiple indexes in parallel with the SHARED DATA DEFINITION clause. The table shows the elapsed time for ten parallel process index creations (Index1, Index2, ... Index10) and one process with ten sequential index creations (All10). In this example, global buffers are enabled and the number of buffers is 500. The longest time for a parallel index creation is Index7 with an elapsed time of 00:02:34.64, compared to creating ten indexes sequentially with an elapsed time of 00:03:26.66. The longest single parallel create index elapsed time is shorter than the elapsed time of creating all ten of the indexes serially.

Table 15−2 Elapsed Time for Index Creations

Index Create Job	Elapsed Time
Index1	00:02:22.50
Index2	00:01:57.94
Index3	00:02:06.27
Index4	00:01:34.53
Index5	00:01:51.96
Index6	00:01:27.57
Index7	00:02:34.64
Index8	00:01:40.56

Index9	00:01:34.43
Index10	00:01:47.44
All10	00:03:26.66

15.5.4 Side Effect When Calling Stored Routines

When calling a stored routine, you must not use the same routine to calculate argument values by a stored function. For example, if the routine being called is also called by a stored function during the calculation of an argument value, passed arguments to the routine may be incorrect.

The following example shows a stored procedure P being called during the calculation of the arguments for another invocation of the stored procedure P:

```
SQL> create module M
cont>     language SQL
cont>
cont>     procedure P (in :a integer, in :b integer, out :c integer);
cont>     begin
cont>     set :c = :a + :b;
cont>     end;
cont>
cont>     function F () returns integer
cont>     comment is 'expect F to always return 2';
cont>     begin
cont>     declare :b integer;
cont>     call P (1, 1, :b);
cont>     trace 'returning ', :b;
cont>     return :b;
cont>     end;
cont> end module;
SQL>
SQL> set flags 'TRACE';
SQL> begin
cont> declare :cc integer;
cont> call P (2, F(), :cc);
cont> trace 'Expected 4, got ', :cc;
cont> end;
~Xt: returning 2
~Xt: Expected 4, got 3
```

The result as shown above is incorrect. The routine argument values are written to the called routine's parameter area before complex expression values are calculated. These calculations may (as in the example) overwrite previously copied data.

The workaround is to assign the argument expression (in this example calling the stored function F) to a temporary variable and pass this variable as the input for the routine. The following example shows the workaround:

```
SQL> begin
cont> declare :bb, :cc integer;
cont> set :bb = F();
cont> call P (2, :bb, :cc);
cont> trace 'Expected 4, got ', :cc;
cont> end;
~Xt: returning 2
```

```
~Xt: Expected 4, got 4
```

This problem will be corrected in a future version of Oracle Rdb.

15.5.5 Considerations When Using Holdable Cursors

If your applications use holdable cursors, be aware that after a COMMIT or ROLLBACK statement is executed, the result set selected by the cursor may not remain stable. That is, rows may be inserted, updated, and deleted by other users because no locks are held on the rows selected by the holdable cursor after a commit or rollback occurs. Moreover, depending on the access strategy, rows not yet fetched may change before Oracle Rdb actually fetches them.

As a result, you may see the following anomalies when using holdable cursors in a concurrent user environment:

- If the access strategy forces Oracle Rdb to take a data snapshot, the data read and cached may be stale by the time the cursor fetches the data.
  For example, user 1 opens a cursor and commits the transaction. User 2 deletes rows read by user 1 (this is possible because the read locks are released). It is possible for user 1 to report data now deleted and committed.
- If the access strategy uses indexes that allow duplicates, updates to the duplicates chain may cause rows to be skipped, or even revisited.
  Oracle Rdb keeps track of the dbkey in the duplicate chain pointing to the data that was fetched. However, the duplicates chain could be revised by the time Oracle Rdb returns to using it.

Holdable cursors are a very powerful feature for read−only or predominantly read−only environments. However, in concurrent update environments, the instability of the cursor may not be acceptable. The stability of holdable cursors for update environments will be addressed in future versions of Oracle Rdb.

You can define the logical name RDMS$BIND_HOLD_CURSOR_SNAP to the value 1 to force all hold cursors to fetch the result set into a cached data area. (The cached data area appears as a "Temporary Relation" in the optimizer strategy displayed by the SET FLAGS 'STRATEGY' statement or the RDMS$DEBUG_FLAGS "S" flag.) This logical name helps to stabilize the cursor to some degree.

15.5.6 AIJSERVER Privileges

For security reasons, the AIJSERVER account ("RDMAIJSERVER") is created with only NETMBX and TMPMBX privileges. These privileges are sufficient to start Hot Standby, in most cases.

However, for production Hot Standby systems, these privileges are not adequate to ensure continued replication in all environments and workload situations. Therefore, Oracle recommends that the DBA provide the following additional privileges for the AIJSERVER account:

- ALTPRI − This privilege allows the AIJSERVER to adjust its own priority to ensure adequate quorum (CPU utilization) to prompt message processing.
- PSWAPM − This privilege allows the AIJSERVER to enable and disable process swapping, also necessary to ensure prompt message processing.

- SETPRV − This privilege allows the AIJSERVER to temporarily set any additional privileges it may need to access the standby database or its server processes.
- SYSPRV − This privilege allows the AIJSERVER to access the standby database rootfile, if necessary.
- WORLD − This privilege allows the AIJSERVER to more accurately detect standby database server process failure and handle network failure more reliably.

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