

**ORACLE®**  
**Oracle Rdb**  
**Release 7.2 & 7.2.1**

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[www.oracle.com/rdb](http://www.oracle.com/rdb)

The slide features a red background with a photograph of a modern glass building on the left. The Oracle logo and product information are centered in white text.



**Steve Hagan, Vice President,  
Oracle Server Technologies**

“For decades, our customers have relied on Oracle Rdb to support large-scale production applications and high-performance transaction processing on HP OpenVMS systems. The latest release extends the quality and stability for which Oracle Rdb is known, while providing customers with more choice and the flexibility to easily move to lower cost systems.”

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The slide features a red background with a photograph of Steve Hagan looking at a laptop on the left. The testimonial text is centered in white, and the Oracle logo and page number are at the bottom.

## Overview of Rdb 7.2

- HP Integrity Servers (aka Itanium, IA64)
- Minor features, enhancements & optimizations

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## Rdb Product Family on Integrity

Oracle Rdb  
Oracle CODASYL DBMS  
Oracle CDD/Repository  
Oracle SQL/Services  
OCI Services for Oracle Rdb  
Oracle Trace for Rdb  
Replication Option for Rdb  
Oracle Rdb JDBC Drivers

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## Rdb 7.2 & OpenVMS

- Databases & application clustered with existing Alpha systems running Rdb 7.2
- OpenVMS on HP Integrity version 8.2-1
- OpenVMS on Alpha version 8.2

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## Database Convert Paths

The diagram illustrates two conversion paths for Oracle Rdb databases:

- Top Path:** A single arrow points from a 'V7.0 or V7.1 DB' to a 'V7.2 DB'. The arrow is labeled 'RMU/CONVERT or RMU/RESTORE'.
- Bottom Path:** A sequence of three database icons. The first is labeled 'DB < V7.0', the second 'V7.0 or V7.1', and the third 'V7.2 DB'. Two arrows connect them, both labeled 'RMU/CONVERT or RMU/RESTORE'.

➤ Database convert or restore

- V7.1 or V7.0 directly to V7.2
- Prior to V7.0 - first to V7.0 or V7.1 & then to V7.2
- RMU/CONVERT takes seconds to run

➤ No application recompile/relink when on same platform

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### Clustering Rdb 7.2

Clustered Alpha and/or I64 Servers

Rdb V7.2 Database

➤ Clustering allows direct access from I64 or Alpha

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The diagram illustrates a clustered architecture. At the top, four server icons are arranged in a semi-circle, labeled 'Clustered Alpha and/or I64 Servers'. Below them, a central cylinder icon represents the 'Rdb V7.2 Database'. Black arrows point from each of the four servers down to the database, indicating direct access. Below the diagram, a red banner contains the text '➤ Clustering allows direct access from I64 or Alpha', the number '7', and the 'ORACLE' logo.

### Remote Network Access to Rdb 7.2 Database

VAX, I64 and/or Alpha  
Rdb-based applications

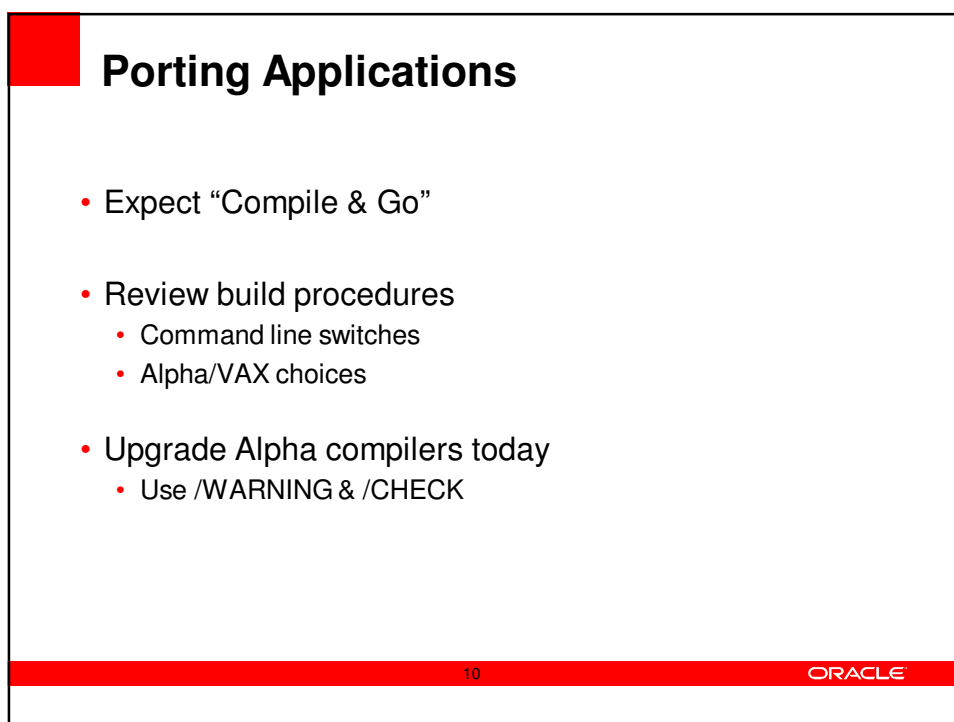
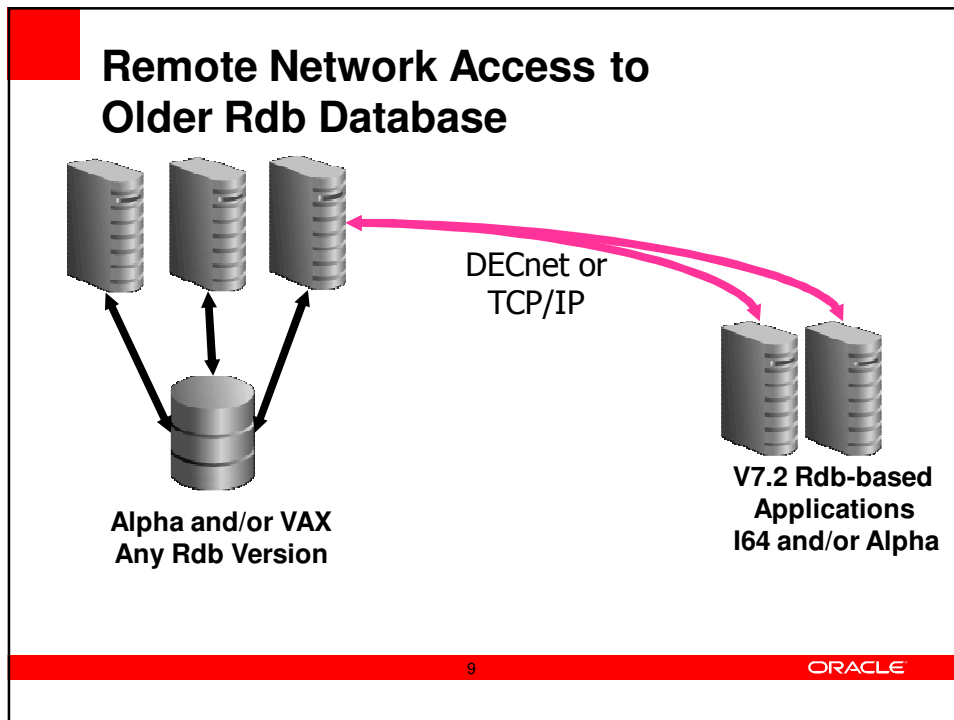
Alpha and/or I64 Servers  
V7.2 Database

DECnet or  
TCP/IP

➤ Built-in network server between versions/platforms  
➤ Multiple versions of Rdb installed & running on a system

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The diagram shows remote network access. On the left, two server icons are labeled 'VAX, I64 and/or Alpha Rdb-based applications'. On the right, three server icons are labeled 'Alpha and/or I64 Servers V7.2 Database'. A central cylinder icon represents the database. Black arrows connect the three servers on the right to the database. Two curved pink arrows point from the applications on the left to the database, with the text 'DECnet or TCP/IP' between them. Below the diagram, a red banner contains two bullet points: '➤ Built-in network server between versions/platforms' and '➤ Multiple versions of Rdb installed & running on a system', the number '8', and the 'ORACLE' logo.



## Porting Applications, continued

- Review source code for Alpha or VAX specific assembly
- Macro (machine or assembler) language

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## Floating point & Integrity

- I64 hardware supports IEEE floating point
  - VAX floating point support emulated in software
- Precompilers support IEEE on Alpha & I64
  - “If in doubt, test it out” – anonymous
- Make sure all modules use same /FLOAT
  - SQL\$PRE / SQL\$MOD & Language compilers

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## Porting: More Difficult Issues

- Linking /SYSEXE
- Inner (ie, non-user) modes
- Knowledge of call stack formats, exception frames, PTE, PFN, PC, FP, AP
- Strict floating point behavior requirements

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## 7.2 Features Increased Limits

- ...Global buffers to 1048576
- ...Database page to 63 blocks
- ...Buffer size limit to 128 blocks
- Many operations now allow up to 256 block IO

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## 7.2 Features Performance

- Index node pre-fetch optimizations
  - Index scans will now prefetch data pointed to by entries in the index before the application actually requests that the rows be returned.
  - Prefetching continues for each entry in the index node until one of the following conditions is met:
    - The database ASYNCH PREFETCH DEPTH IS n BUFFERS limit is reached
    - The end of the current index node is encountered
    - A pointer to a duplicates node is encountered
    - The key with the ending scan value is found
    - A zig-zag strategy skip is requested

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## 7.2 Features Performance

- Transaction rollback optimizations
  - I/Os are now done using 256 block buffers.
  - Multiple buffers are now used to read the journal.
  - No use of intermediate buffers anymore.
  - Asynchronous prefetches (APF) are issued for pages that will be rolled back.
  - Location of the last journal entry is maintained in shared memory, avoiding the DBR to scan the journal.

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## 7.2 Features Performance

- Caching of database AIP entry information
  - AIP entry is copied into an extended lock value block.
  - This reduces IOs on RDB\$AIP, especially if there are many tables in the database.
- VMS file caching disabled for backup operations
- RDB\$SHOVER, RDB\$SETVER, SQL\$SETVER
  - No temporary files anymore, thus avoiding IOs.
  - Avoiding problems if SYS\$SCRATCH is not properly defined.

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## 7.2 Features Performance

- Constant boolean selections recognized

```
SQL> SELECT * FROM EMPLOYEES WHERE 1 = 2;
```

- Queries against RDB\$DATABASE optimized

```
SQL> SELECT {some datum} FROM RDB$DATABASE;
```

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## 7.2 Features Performance

- Index column group now enabled by default
  - The optimizer will try to find an index that has the same leading columns as the columns of Index Column Group (or Workload Column Group).
  - If a match is found, it uses the index prefix cardinality to calculate the column duplicity and null factors which will help the optimizer to estimate solution costs and cardinalities with higher accuracy.
- Refined index estimation enabled by default
  - Index estimation was normally performed by descending to the split level in sorted indexes.
  - Estimation refinement rules were available to enable greater precision in estimation on indexes of TYPE IS SORTED RANKED and to enable estimation on hashed indexes.
  - These rules were enabled using the REFINE\_ESTIMATES flag.

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## 7.2 Features Space Reclamation

- Deleted Space in Uniform Areas Now Reclaimed by Other Users
  - In prior releases of Oracle Rdb, when rows were deleted from a table stored in a uniform storage area, other database users would not be aware that space was made available and could extend the storage area when inserting additional rows in the table even though free space was available.
  - Free space location for uniform areas now tracked in shared memory (therefore only for users on the same cluster node).

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## 7.2 Features

### RMU/SHOW STATISTICS

- 64-bit counters
- Additional statistics screens

```

Node: RANDM4 (1/1/16) Oracle Rdb V7.2-011 Perf. Monitor 28-APR-2006 13:13:15.81
Rate: 3.00 Seconds           Rdb Executive Statistics           Elapsed: 20:52:25.59
Page: 1 of DISK$RANDOM_SYS: [RDB_RANDOM.PMEAD.INSERTTEST] TESTDB.RDB;1Mode: Online
-----

```

statistic.....	rate.per.second.....			total.....	average.....
	max.....	cur.....	avg.....		
name.....					
queries compiled	0	0	0.0	10	1.2
index scans	0	0	0.0	6	0.7
index only	0	0	0.0	0	0.0
index full	0	0	0.0	0	0.0
dynamic optimizer	0	0	0.0	2	0.2
one abandoned	0	0	0.0	0	0.0
all abandoned	0	0	0.0	0	0.0

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## 7.2 Features

### RMU/SHOW STATISTICS

- Sequential Scan added to Record Statistics screen

```

Node: RANDM4 (1/1/16) Oracle Rdb V7.2-011 Perf. Monitor 28-APR-2006 13:33:01.34
Rate: 3.00 Seconds           Record Statistics           Elapsed: 21:12:11.12
Page: 1 of DISK$RANDOM_SYS: [RDB_RANDOM.PMEAD.INSERTTEST] TESTDB.RDB;1Mode: Online
-----

```

statistic.....	rate.per.second.....			total.....	average.....
	max.....	cur.....	avg.....		
name.....					
.					
.					
sequential scan	0	0	0.0	0	0.0
record fetched	0	0	0.0	0	0.0

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## 7.2 Features RMU Time Qualifiers

- Absolute & Delta time accepted for qualifiers

```
$ RMU/SHOW STATISTICS/NOINTER/OUT=STATS/UNTIL="+1:0:0" DB
$ RMU/SHOW STATISTICS/NOINTER/OUT=STATS/UNTIL=TOMORROW DB
```

## 7.2 Features RMU/SHOW LOCKS

- RMU SHOW LOCKS /RESOURCE\_TYPE Qualifier added
  - When the /RESOURCE\_TYPE=(restyp...) qualifier is present on the command line, only the specific resource types will be displayed.
  - This permits, for example, only PAGE or RECORD lock types to be selected.
  - The RESOURCE\_TYPE qualifier is incompatible with the MODE, LIMIT, LOCK and PROCESS qualifiers.
- RMU/SHOW LOCKS Includes Time and Node Name

```
$ RMU /SHOW LOCKS

=====
====
SHOW LOCKS Information at 26-NOV-2005 09:29:01.21 on node
RDBI64
```

## 7.2 Features

### Encrypted Backups

- Encrypted database & after-image journal backups for protection of confidential data

```
$ RMU/BACKUP/ENCRYPT=(VALUE="My secret key") -
  MYDB.RDB MYBACKUP.RBF

$ RMU/RESTORE/ENCRYPT=(VALUE="My secret key") -
  MYBACKUP.RBF

$ ENCRYPT /CREATE_KEY /LOG HAMLET -
  "And you yourself shall keep the key of it"
%ENCRYPT-S-KEYDEF, key defined for key name = HAMLET
$ RMU/BACKUP/ENCRYPT=NAME=HAMLET MYDB.RDB MYBACKUP.RBF
```

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## 7.2 Features

### New LIMIT TO Syntax

- The 100th employee from EMPLOYEES:

```
SQL> select last_name, first_name, employee_id
cont> from employees order by employee_id
cont> limit to 1 skip 99 rows;
  LAST_NAME      FIRST_NAME      EMPLOYEE_ID
Herbener         James           00471
1 row selected
```

- The last row in a sorted list:

```
SQL> select last_name, first_name, employee_id
cont> from employees order by employee_id
cont> limit to 1
cont> skip (select count(*)-1 from employees) rows;
  LAST_NAME      FIRST_NAME      EMPLOYEE_ID
Herbener         James           00471
1 row selected
```

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## Increase Memory Related Quotas

- Executable images typically 2x to 4x larger
- 7.2 uses larger internal buffers

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## %ILINK-E-INVORINI

```
%ILINK-E-INVORINI, incompatible multiple
initializations for overlaid section
  section: {psect; typically a "handle"}
  module: {module with overlay}
  file: {object module}
  module: {other module with overlay}
  file: {other object module}
```

- VAX & Alpha linkers allowed multiple psect overlays with different values.
- Itanium linker flags this as an error because on I64 systems, the ELF (Executable and Linkable Format) object language does not implement the feature of the Alpha and VAX object language which allows the initialization of portions of sections.

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## Shareable Images & PTHREAD\$RTL

- If application utilizes shareable images that invoke posix threads then main image must be linked with thread RTL

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## Use Same Case for External Functions

- IA64: SQL External Procedures must use same case for location or the image loader will think it is a different image.

```
create procedure sys$gettim(  
  in :timadr date vms by reference);  
external location  
  'SYS$SHARE:SYS$PUBLIC_VECTORS.EXE'  
language general general parameter style;
```

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## 7.2 Features

### SQL SHOW STATISTICS

```
SQL> SHOW STATISTICS

           process statistics at 28-APR-2006 14:28:10.43
elapsed time = 0 00:00:05.35      CPU time = 0 00:00:00.07
buffered I/O count = 104          direct I/O count = 133
open file count = 10              file quota remaining = 19990
locks held = 83                   locks remaining = 19917
CPU utilization = 1.3%            AST quota remaining = 196
```

## 7.2 Features

### SQL ALTER TABLE

- The ALTER COLUMN clause has been enhanced.
  - It now allows columns to be altered to and from COMPUTED BY, AUTOMATIC and IDENTITY special columns.
- The ADD CONSTRAINT clause has been improved.
  - Running this different sessions in parallel would either stall waiting for another transaction to finish or fail with a deadlock.
  - To provide better concurrency, ADD CONSTRAINT can be used when the target table is reserved in DATA DEFINITION mode.
  - Most ALTER TABLE clauses are now supported for tables reserved for SHARED DATA DEFINITION.



## Rdb 7.2 Retired Features

- ACE (AIJ Cache on Electronic disk)
- WORM (Write Once Read Many) Storage

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## Oracle Rdb Release 7.2.1

- Released February 2007
- OpenVMS V8.3 certification on Alpha & I64
- I64 Montecito-based systems
  - Multi-core
  - Multi-thread

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## 7.2.1 Features

- Compression support for RMU /UNLOAD & RMU /LOAD
  - A new /COMPRESSION qualifier has been added to RMU Unload.
  - The default remains /NOCOMPRESSION.
  - This qualifier accepts the following optional keywords: LZW, ZLIB, LEVEL and EXCLUDE\_LIST.
  - The compression algorithms used are ZLIB (the default) or LZW.
  - ZLIB allows further tuning with the LEVEL option that accepts a numeric level between 1 and 9.
  - The default of 6 is usually a good trade off between result file size and the CPU cost of the compression.
  - No new qualifiers are required by RMU Load, the interchange file contains the compression information.

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## 7.2.1 Features

- Vastly improved compression for RMU /BACKUP
  - The ZLIB algorithm and software has been implemented for RMU /BACKUP /COMPRESS.
  - This implementation generally uses the same or less CPU time and is generally more effective (compresses better) than either of the HUFFMAN or LZSS algorithms.
  - When using the /ENCRYPT and /COMPRESS features together, data is first compressed and then encrypted. This provides effective compression as well as effective encryption.

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## 7.2.1 Features

- Improved IO behaviour for RMU /BACKUP, RMU /COPY & RMU /MOVE
  - New qualifier /THREADS=n
  - RMU creates so called internal 'threads' of execution to read data from one specific storage area.
  - Threads run quasi-parallel within the process executing the RMU image.
  - The more threads, the more I/Os can be generated at one point in time and the more resources are needed to accomplish the same task.

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## 7.2.1 Features

- Most run-time durations captured more precisely
  - Improved precision with IO, lock & transaction durations
  - E.g.
    - 16:23:16.1776975
    - 13-NOV-2006 16:23:16.1776975

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## 7.2.1 Features

- Record length on AIP updated at ALTER TABLE action that changes on-disk length
  - In prior releases of Oracle Rdb, the record length in the AIP (area inventory pages) was set when the table was created.
  - Subsequent ALTER TABLE statements that added new columns, changed column length or data types, or dropped columns would not update this length.
  - The ALTER TABLE statement will track changes in the length of the table row.
  - These actions to update the AIP are deferred until COMMIT time.

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## 7.2.1 Features

- New RMU Show AIP Command Added
  - Better than RMU/DUMP/LAREA=RDB\$AIP
  - Format:  
`RMU/SHOW AIP rootfile [ larea-name ] [/LAREA=(n [,...]) ]`  
`[/OPTION=REBUILD_SPAMS]`  
`[/OUTPUT=output-filename] [/TYPE=type-name]`
- New RMU Set AIP Command Added
  - Better than RMU/REPAIR/INITIALIZE=LAREA\_PARAMETERS
  - Format:  
`RMU/SET AIP root-file-spec larea-name [/LAREA=(n [, ...])]`  
`[/LENGTH[=n]] [/LOG]`  
`[/REBUILD_SPAMS] [/RENAME_TO=new-name]`  
`[/THRESHOLD=(p,q,r)]`

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## 7.2.1 Features

- **CALL Statement From Trigger Action Can Now Update Tables**
  - In prior releases of Oracle Rdb, the CALL statement could only SELECT data from other tables.
  - Now the CALL statement may INSERT, DELETE and UPDATE tables as well as CALL other routines.
  - Restriction: The table which is the target for the trigger, known as the morphing table, may not be updated by any stored procedure or function called within the scope of the trigger activation.

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## 7.2.1 Features

- **Using OpenVMS Reserved Memory Registry With Rdb**
  - This reserved memory can be useful to allow the use of granularity hint (GH) regions.
  - This can improve performance by using fewer processor translation buffer entries to map a large range of physical memory pages.
  - Use of the reserved memory is optional and any performance gains are application specific.
  - To reserve the memory, use the SYSMAN utility RESERVED\_MEMORY ADD command and then run AUTOGEN.
  - The global section name that is necessary to know for the above command is now displayed in the RMU/DUMP/HEADER output.

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## 7.2.1 Features

- **Server Output File Names As Database Attributes**
  - Logical names like RDM\$BIND\_DBR\_LOG\_FILE need to be defined system-wide.
  - That is impractical because it could effect the servers of multiple databases.
  - This has been improved by using an RMU command to specify the logfile as a database attribute, e.g.:
 

```
$ RMU /SET SERVER DBR –
  /OUTPUT=DBR$LOGS:DBR.LOG DUA0:[ADB]ADB.RDB
```
  - The same is possible for the ABS, ALS, LRS, LCS and RCS processes.

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## 7.2.1 Features

- **New Hot Standby Status Symbols**
  - The RMU /SHOW AFTER\_JOURNAL /BACKUP\_CONTEXT command creates two new symbols.
  - RDM\$HOT\_STANDBY\_STATE
  - RDM\$HOT\_STANDBY\_SYNC\_MODE
- **RMU/BACKUP /NORECORD New Qualifier**
  - The qualifier has been added to avoid the modification of the database with recent backup information.
  - Hence the database appears like it had not been backed up at this time.
  - The main purpose of this qualifier is to allow a backup of a hot standby database without modifying the database files.

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## Summary

Rdb 7.2 and 7.2.1 well tested & stable

Migrating to Integrity is easy

Improved Performance

Excellent Reliability & Performance on Integrity

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**Ann McQuaid**  
**General Manager**  
**HP OpenVMS**


“We are delighted that Oracle has strengthened its commitment to OpenVMS on HP Integrity servers. We are extremely pleased about our continued long-term relationship, delivering some of the industry’s most robust, available and secure solutions to support the dynamic and critical needs of customers.”

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