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Oracle Database on OpenVMS and Oracle Rdb Product Family Update

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Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Agenda

- Working with VSI and HPE
- Customer Focus
- Oracle Database on VMS Update
  - Support Dates
  - 11g , 10g
  - What's Under Development
  - Roadmap
- Oracle Rdb and CODASYL DBMS Update
  - Support Dates
  - Recent Releases
  - What's Under Development
  - Roadmap

Working with VSI and HPE

- Oracle remains in close contact with both VSI and HPE
  - In resolution of customer issues
  - Oracle OpenVMS dependencies
  - Development Projects (e.g. Java 1.8)
  - Customer Events
  - Monthly conference calls with HPE
  - As needed communication with VSI (often weekly)
- Participation in EMEA HPUG events, e.g. Paris, December, 2017
- Participation in the Connect Conferences – e.g. Leipzig, May, 2018
- Monthly meetings with HPE Japan
- Efforts to strengthen working relationships between Oracle/VSI in progress

Oracle on OpenVMS and Oracle Rdb Marketing Focus

- Focus on meeting our customers' needs
- Rdb Web page, Rdb Web Journal, My Oracle Support, OTN
- Rdb management personal customer visits /meetings
- Events
  - HPE and VSI Events
  - OpenVMS SIG Groups

- **Customer Events (2018)**
  - Connect Deutschland, May 14-16, 2018
  - Swedish OpenVMS SIG, May 21, 2018
  - UK OpenVMS SIG, May 23, 2018
  - French OpenVMS SIG, (TBD)
- **Boot Camp & Oracle Technical Forums (2019)**
  - Boot Camp, April 7-10, 2019
  - Forums to follow Boot Camp
    - Nashua, NH , April 11-12, 2019
    - Redwood Shores, (TBD)
    - EMEA, (TBD)
    - Asia, TBD)

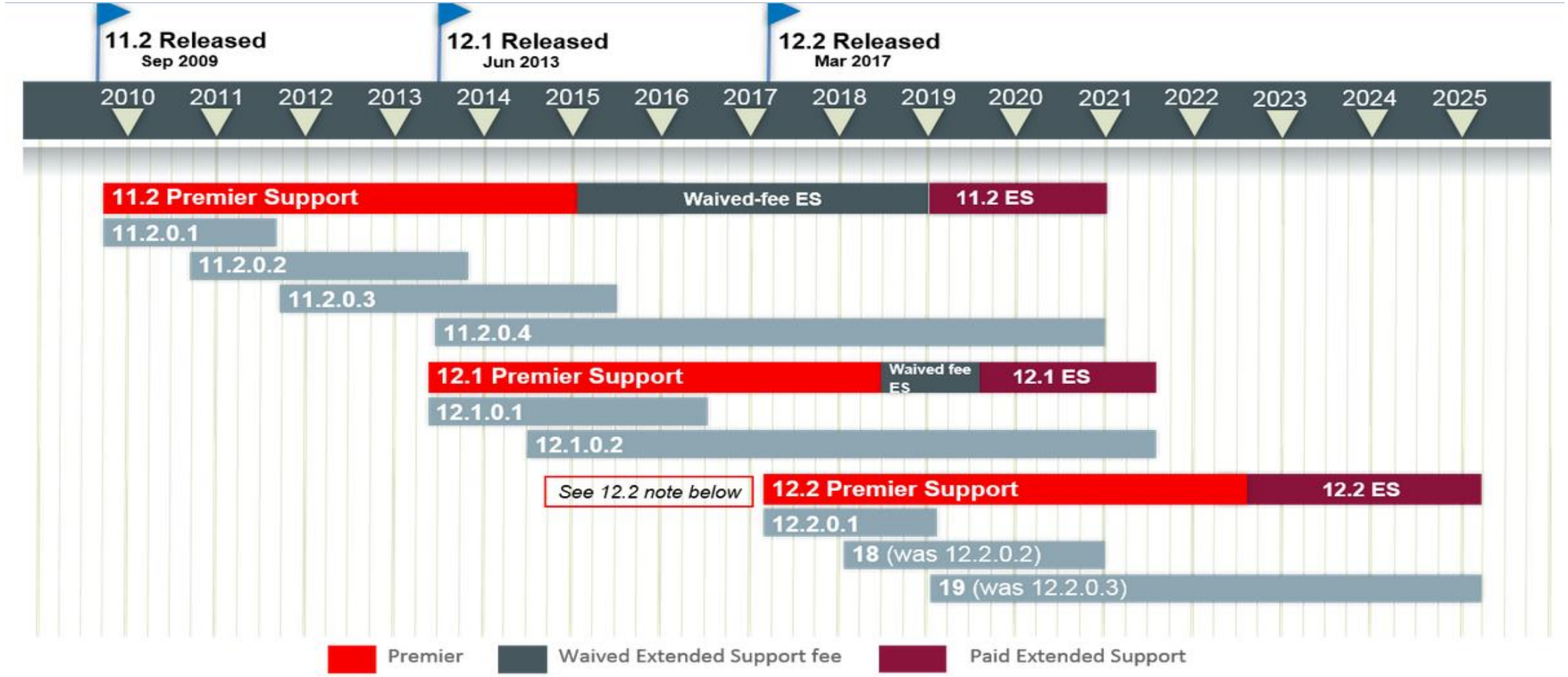
Oracle's Lifetime Support Policy

- **Oracle Premier Support** provides customers with maintenance and support of Oracle software on Itanium servers for five years from the general availability date of the software release.
- **Oracle Extended Support** provides customers with an extra three years of support for specific Oracle releases for an additional fee. Customers benefit from the same quality of service received with Oracle Premier Support, with the security of knowing they can migrate their software to a new platform when the time is right.
- **Oracle Sustaining Support** customers will receive technical support for as long as they operate their Itanium-based systems—including access to online support tools, knowledge bases, pre-existing fixes and assistance from technical support experts.
- Oracle Lifetime Support

Oracle Database 10gR2 Support Dates

Integrity Platforms	
Platform	Additional Extended Support: S1 Fixes Only
HP OpenVMS on Integrity	August 2013 – July 2017
HP OpenVMS on Alpha	August 2013 – July 2015
HP-UX	August 2013 – Dec 2015
Linux Integrity	August 2013 – Dec 2015
Windows Integrity	August 2013 – Dec 2015

Oracle 11g & 12c Support Dates



Oracle 11g OpenVMS Patch Set Updates (PSUs)

- 11.2.0.4.180417DBPSU – April, 2018
- 11.2.0.4.180116DBPSU – January, 2018
- 11.2.0.4.171017DBPSU – October, 2017
- 11.2.0.4.170718DBPSU – July, 2017
- 11.2.0.4.170418DBPSU – April, 2017
- 11.2.0.4.161018DBPSU - October, 2016
- 11.2.0.4.160719DBPSU - July, 2016

Oracle 11g OpenVMS Patch Set Updates (PSUs) – cont.

- 11.2.0.4.10 - April, 2016
- 11.2.0.4.9 - January, 2016
- 11.2.0.4.8 - October, 2015
- 11.2.0.4.7 - July, 2015

11.2.0.4.180417DBPSU on MOS

Patch Details

Patch 27338049: DATABASE PATCH SET UPDATE 11.2.0.4.180417

Last Updated Apr 17, 2018 1:38 AM (17 days ago)

Product Oracle Database - Enterprise Edition (More...)
Release Oracle 11.2.0.4.0
Platform HP OpenVMS Itanium

Size 113.4 MB
Download Access Software
Classification Security
Patch Tag All Database

Recommendations / Certifications

Recommended for Oracle Database 11.2.0.4.0

Bugs Resolved by This Patch

10136473	CELLSRV FAILS DUE TO ORA-7445 [KAF4F0RST9IR2SRP1]
11733603	ORA-54 WITH SELECT STATEMENT USING NOWAIT CLAUSE WITH NO CONCURRENT ACTIVE TX
11883252	REDO TRANSPORT STREAMING NOT SUPPORTED WITH ALL MIXED VERSION CONFIGURATIONS
12364061	QUERY FAILS INTERMITTEND WITH ORA-30054
12611721	ARCHIVELOG DELETION POLICY BACKED UP N TIMES TO 'SBT_TAPE' IGNORED
12747740	NODE JOIN RECONFIGURATION (PCMREPLAY) DOES NOT SCALE WITH MORE LMS'S
12816846	INTERNAL ERROR WHILE UPDATING COLUMN OF UPDATABLE JOIN VIEW ON EV AND TABLE/VIEW
12905058	REBOOT 2 CELL NODES, CHECKFILE FOUND CORRUPTION BLOCK IN 3 UNDO DATAFILES
12982566	ORA-06550: DBMS_DRS PACKAGE DOES NOT EXIST ON NEW STANDBY DB AFTER SWITCHOVER
13364795	COLUMNAR SMART SCAN CAN FAIL TO RECOVER FROM A CORRUPT BLOCK

11g and 10g Certifications on VSI OpenVMS Versions

- Itanium (i6)
  - 8.4-2L1
- Itanium (i4 and i2)
  - 8.4-2L1
  - 8.4-2
  - 8.4-1H1
- Alpha (Oracle Rdb Only)
  - 8.4-2L1
  - 8.4-2L2 (optimized for EV56 and higher)
    - Certification completed

Itanium OpenVMS Certification Matrix (Doc ID 377470.1)

Support Matrix for hp ITANIUM OpenVMS versions and Oracle Server releases

Last Update: 10-May-2018
Updated by: Dave Hayter

ITANIUM/OpenVMS (Refer to Note:377480.1 for recommended OpenVMS ECO levels)

8.2-1	8.3	8.3-1H1	8.4	8.4-1H1	8.4-2	8.4-2L1
			**see Note A	**see Note B	**see Note B	**see Note C
			11.2.0.4.0	11.2.0.4.0	11.2.0.4.0	11.2.0.4.0
			**see Note D		**see Note H	**see Note H
			10.2.0.5.0	10.2.0.5.0	10.2.0.5.0	10.2.0.5.0
			**see Note E			**see Note J
10.2.0.4.0	10.2.0.4.0	10.2.0.4.0	10.2.0.4.0			
10.2.0.2.0	10.2.0.2.0	10.2.0.2.0				
	**see Note F					

Itanium OpenVMS Certification Matrix (Doc ID 377470.1)

(For hp ALPHA OpenVMS Certification matrix - see Note:62150.1)

Please refer to the following document for information on release schedules:

Document 742060.1 Release Schedule of Current Database Releases

Please note that at this time, we do not support the Oracle RDBMS and related products running
on OpenVMS as a guest operating system (e.g Virtual Machines)

A. OpenVMS 8.4 Oracle certification includes HP Integrity i2 (Tukwila) hardware.

B. OpenVMS 8.4-1H1 and 8.4-2 Oracle certification includes HP Integrity i4 (Poulson) and i2 (Tukwila) hardware.

C. OpenVMS 8.4-2L1 Oracle certification includes HP Integrity i6 (Kittson), i4 (Poulson) and i2 (Tukwila) hardware.

D. Oracle Server/Client Release 11.2.0.4 (11gR2) for Itanium OpenVMS was released on 23rd July 2015.

This release requires a minimum of OpenVMS 8.4

The install kits are currently available for download on Oracle Technology Network :

http://www.oracle.com/technetwork/database/enterprise-edition/downloads/index.html

Please note that Oracle Clusterware/RAC 11gR2 will be released at a later date.

E. Patch set 10.2.0.5 was announced 31st October 2012 and is now available from the MyOracleSupport (MOS) patches dowr

Alpha OpenVMS Certification Matrix (Doc ID 62150.1)

ALPHA/OpenVMS (Refer to Note:170199.1 for recommended OpenVMS ECO levels)

7.1	7.2	7.3	8.2	8.3	8.4
		** see Note L	** see Note M		
					10.2.0.5.0
					** see Note A
			10.2.0.4.0	10.2.0.4.0	10.2.0.4.0
			10.2.0.2.0	10.2.0.2.0	
			** see Note B		
		10.1.0.5.0	10.1.0.5.0	10.1.0.5.0	
		10.1.0.3.0	10.1.0.3.0	10.1.0.3.0	
			** see Note C		

Oracle 11g on OpenVMS – Current Development

- RAC
  - Code merge phase completed
  - Run-time phase underway
    - Issue:
      - Multicast Domain Name server which come from the Apple/Bonjour
      - Routing socket CRTL support needed from within the TCP/IP package
      - Multicasting capability needed through the tcpip$interface APIs
        - Berkley BSD or Netlink API

What Oracle 11g Client Kit Provide to OpenVMS

- Client/Server Interoperability Support to future database releases
- Standard Supported client tools (next slides)
- Upgraded Security Functionality
- Gives you the ability to continue to run your application on VMS while connecting to the database server platform of your choice (either to a VMS server or to other platforms supported by Oracle).

Client / Server / Interoperability Support Matrix For Different Oracle Versions [ID 207303.1]

Client Version	Server Version						
	12.2.0 #10	12.1.0	11.2.0	11.1.0	10.2.0	10.1.0	9.2.0
12.2.0	Yes	Yes	Yes	No	No	No #3	No #3
12.1.0	Yes	Yes	Yes	Was	MDS #7	No #3	No #3
11.2.0	Yes #9	Yes	Yes	Was	MDS #7	No	Was #5
11.1.0	No	Was	Was	Was	Was #7	Was #6	Was #5
10.2.0	No	MDS #7	MDS #7	Was #7	MDS	Was	Was #5
10.1.0 #4	No	No	Was #6	Was #6	Was	Was	Was
9.2.0	No	No #8	Was #5	Was #5	Was #5	Was	Was

Key:

Yes	Supported
ES	Supported but fixes only possible for customers with Extended Support .
LES or MDS	Supported but fixes only possible for customer with a valid Limited Extended Support or Market-Driven Support contract respectively.
Was	Was a supported combination but one of the releases is no longer covered by any of Premier Support, Primary Error Correct support, Extended Support, nor Extended Maintenance Support. Fixes are no longer possible.
No	Has never been Supported

11g Client Kit Contents

- Oracle SQLJ
- Oracle Database Utilities
- Oracle Java Client
- SQL*Plus
- Oracle JDBC/THIN Interfaces
- Oracle Internet Directory Client
- Oracle Call Interface (OCI)
- Oracle Programmer
- Oracle XML Development Kit
- Oracle Advanced Security
- Enterprise Manager Minimal Integration
- OLAP Analytic Workspace Manager and Worksheet
- Oracle Net

11g Client Kit Contents (cont.)

- Oracle Connection Manager
- Oracle Net Listener
- Oracle Multimedia Client Option
- Oracle ODBC Driver
- Oracle Clusterware High Availability API
- Oracle SQL Developer
- Oracle Scheduler Agent
- Oracle Services For Microsoft Transaction Server
- Oracle Administration Assistant for Windows
- Oracle Counters for Windows Performance Monitor
- Oracle Objects for OLE
- Oracle Provider for OLE DB
- Oracle Data Provider for .NET
- Oracle Providers for ASP.NET

Oracle Rdb Product Family Update

What Products Make up The Rdb Product Family?

- Oracle Rdb Server
- Oracle CODASYL DBMS
- Oracle Trace
- Oracle CDD/Repository
- Oracle JDBC for Rdb
- Oracle Rdb Developer Tools for Visual Studio
- Oracle Rdb Connectivity Manager
- Oracle Rdb Extension for SQL Developer
- Oracle Rdb Extension for Oracle Enterprise Manager
- Oracle ODBC Driver for Rdb
- Oracle SQL/Services & OCI Services for Oracle Rdb
- Oracle Replication Option

Rdb Product Family Lifetime Support Dates

Oracle Rdb and Oracle CODASYL Database Releases

Release	GA Date	Premier Support Ends	Extended Support Ends	Sustaining Support Ends
7.0	Oct 1996	Aug 2007	Aug 2009	Indefinite
7.1	Jul 2001	Dec 2007	Dec 2010	Indefinite
7.2	Jan 2006	Jul 2015	Jul 2017	Indefinite
7.3	Mar 2011	Sep 2020	Sep 2023	Indefinite

See: http://www.oracle.com/us/support/library/lifetime-support-technology-069183.pdf

Oracle Rdb Certifications

Oracle Rdb V7.3

Release	Release Date	Version	Alpha			Itanium			Update
			Min	Max	Kits [1]	Min	Max	Newest Processor	
7.3.2.1	Mar 2017	V7.3-210	8.4	8.4-2L2	.1	8.4	8.4-2L1	i6 (Kittson)[2]	3
7.3.2.0	Mar 2016	V7.3-200	8.4	8.4-2L1	.1	8.4	8.4-2L1	i4 (Poulson)	5
7.3.1.3	Oct 2015	V7.3-130	8.3	8.4-x	.1	8.3	8.4-2L1	i4 (Poulson)	1
7.3.1.2	Oct 2014	V7.3-120	8.3	8.4-x	.1	8.3	8.4-1H1	Tukwila	2
7.3.1.1	Feb 2014	V7.3-110	8.3	8.4-x	.1	8.2-1	8.4	Tukwila	1
7.3.1.0	Sep 2013	V7.3-100	8.3	8.4-x	.1	8.2-1	8.4	Tukwila	None

Rdb V7.3 is in premier support.

[1]The ALPHA version is optimized for EV56 or later processors and shown as V7.3-nn1. Older, pre-EV56 processors are not supported.
[2]Minimum OpenVMS for i6 systems is 8.4-2L1

Source: Comprehensive Rdb Versions and Compatibility Matrix (MOS Doc ID 66729.1)

Oracle Rdb Certifications (cont.)

Oracle Rdb V7.2

Release	Release Date	Version	Alpha			Itanium			Update
			Min	Max	Kits [1]	Min	Max	Processor	
7.2.5.8	May 2017	V7.2-580	8.2	8.4-x	.0 / .1	8.2-1	8.4-1H1	i2	None
7.2.5.7	Aug 2015	V7.2-570	8.2	8.4-x	.0 / .1	8.2-1	8.4-1H1	Tukwila	None
7.2.5.6	Apr 2015	V7.2-560	8.2	8.4-x	.0 / .1	8.2-1	8.4-1H1	Tukwila	None
7.2.5.5	Jun 2014	V7.2-550	8.2	8.4-x	.0 / .1	8.2-1	8.4	Tukwila	None
7.2.5.4	Feb 2014	V7.2-540	8.2	8.4-x	.0 / .1	8.2-1	8.4	Tukwila	None
7.2.5.3	July 2013	V7.2-530	8.2	8.4-x	.0 / .1	8.2-1	8.4	Tukwila	None

Source: Comprehensive Rdb Versions and Compatibility Matrix (MOS Doc ID 66729.1)

Oracle CODASYL DBMS Certifications

Oracle CODASYL DBMS V7.3

Release	Release Date	Version	Alpha			Itanium			Update
			Min	Max	Kits [1]	Min	Max	Processor	
7.3.1	Nov 2013	V7.3-10	8.3	8.4-2L2	8.3/8.4-2L1	8.3	8.4-2L1	i6(Kittson)[2]	

DBMS V7.3 is in premier support.

[1]The ALPHA version is optimized for EV56 or later processors. Older, pre-EV56 processors are not supported.
[2]Minimum OpenVMS for i6 systems is 8.4-2L1

Source: Comprehensive Rdb Versions and Compatibility Matrix (MOS Doc ID 66767.1)

Rdb Product Family Releases Over the Past 2 Years

- Rdb 7.3.3.0 , May, 2018
- Oracle Rdb Developer Tools for Visual Studio, 7.3.6.0, March 2018
- Oracle JDBC for Rdb 7.3.5.1, March, 2018
- Rdb 7.3.2.1 , Update 3, November, 2017
- Rdb 7.3.2.1, Update 2, September, 2017
- Oracle JDBC for Rdb 7.3.5, August, 2017
- Rdb Connectivity Management, 7.3.2.0, August, 2017
- Rdb 7.3.2.1, Update 1, June, 2017
- Rdb 7.2.5.8, May, 2017
- Oracle Rdb ODBC 3.3.2.5 , April, 2017
- Rdb 7.3.2.1, March , 2017
- SQL/Services 7.3.2.3, March, 2017
- Rdb 7.3.2, Update 4, March, 2017
- Rdb 7.3.2, Update 3, November, 2016
- Rdb 7.3.2, Update 2, September, 2016
- RMU Reference Manual, September, 2016
- SQL Reference Manual, September, 2016
- Rdb 7.3.2, Update 1, May, 2016
- SQL/Services 7.3.2.2, April, 2016
- Rdb 7.3.2, March, 2016

Rdb 7.2.5.8, May, 2017

- Download from My Oracle Support
  - Patch 26167807 for Itanium
  - Patch 26167817 for Alpha
- Problems fixed in this release include::
  - Unexpected Alignment Faults When Converting Floating Values to Text
  - Unexpected SQL Bugchecks When the Logical RDM$BIND_KODA_DEBUG is Defined
  - Unexpected Bugcheck After an Exception is Reported Inserting LIST OF BYTE VARYING Column
  - Unexpected Bugcheck Generated When NOT LIKE Used With a Literal

Rdb 7.3 Releases

- V7.3.1 - September 2013
- V7.3.1.1 - February 2014
  - Update 1, OCT, 2014
- V7.3.1.2 - October 2014
  - Update 1, October, 2014
  - Update 2, January, 2015
  - Update 3, February, 2015
- V7.3.1.3 – September, 2015
  - Update 1 – October, 2015
    - This includes the same patches as Update 3 for V7.3.1.2

Rdb 7.3 Releases (Continued)

- V7.3.2 – March, 2016
  - Update 1, May, 2016
  - Update 2, September, 2016
  - Update 3, November, 2016
  - Update 4, March, 2017
- V7.3.2.1, March, 2017
  - Update 1, June, 2017
  - Update 2, September, 2017
  - Update 3, November, 2017
- V7.3.3.0 – May, 2018

Sample of Problems Fixed in 7.3.x + Capabilities

- i6 and i4 (Kittson, Poulson)
- Wrong Results
- Alignment Faults
- Bugchecks
- Log Miner
- Performance (Optimizer)
- RMU Show Statistics
- Sorted Ranked Index
  - e.g. Unexpected Bugcheck When Updating a SORTED
- Hot Standby

Oracle Rdb 7.3.2.1 Available for Download

Patch Details

Patch 25682708: ORACLE RDB RELEASE 7.3.2.1.0 FOR OPENVMS ITANIUM

Last Updated Mar 16, 2017 8:13 AM (7+ hours ago)

Product	Oracle Rdb Server on OpenVMS
Release	RDB 7.3
Platform	HP OpenVMS Itanium

Size	86.6 MB
Download Access	Software
Classification	General
Patch Tag	

Bugs Resolved by This Patch

List of bugs fixed is not available. Consult the Readme.

View Related Knowledge to this Patch

Rdb 7.3.3 New Features and Enhancements

- Relaxed Type Checking for DEFAULT Clause
- New Statistics Screen Shows Top Processes Accessing a Table Logical Area
- Relaxed Naming Rules for RMU Extract Option=MATCH Option
- RMU/RESTORE Now Always Displays the %RMU−I−AIJRECFUL Message
- New SQL Built−in Functions
- New String Functions
- New Aggregate Functions
- RMU−F−DBROOTFILE, −RMU−F−DBDATAFILE messages output with %RMU−F−BADAIJFILE

Rdb 7.3.3.0 New Features and Enhancements (cont.)

- RMU Extract Now Outputs ALTER DATABASE For Storage Area Access Mode
- RMU/RECOVER RMU−F−BACKUPNOAIJ, RMU−F−TSNNOSYNC, RMU−F−CANTSYNCTSNS Error Messages
- Delimited_Text Keywords Can Now Be Negated For RMU Load And Unload
- RMU Load Now Supports User Defined Conversion Routines
- New CARDINALITY Option for SHOW TABLE Command
- New CONSTRAINT Naming for Domain Constraints
- New AS Result−type Clause for CREATE SEQUENCE Statement

Rdb 7.3.3.0 New Features and Enhancements (cont.)

- New GENERATED Column Support
- Enhancements to INCLUDE Statement
- New Support for DEFAULT Index NODE SIZE Calculation
- New LANGUAGE Support From RMU Extract Command
- Enhancements for CREATE and ALTER MODULE Statements
- New RMU Dump Symbols Command
- New Options to SET SQLDA Statement
- More New Options to SET SQLDA Statement

Rdb 7.3.3 Bugs Fixed - All Interfaces

- Unexpected RDB−E−BAD_DPB_CONTENT Error During ATTACH to a Database
- Possible Wrong Results From Partitioned Indices
- Unexpected Results From Partitioned Index Query
- Possible Lost Database Updates When Using RMU Backup Incremental
- Deterministic Function Not Treated As Deterministic
- Unexpected Bugcheck Generated When RDMS$RUJ References Bad File Specification
- Wrong Result From Aggregate Functions Using DISTINCT and FILTER Clauses
- LSEDIT Support Not Installed When Only DECSET License Was Found
- Sub−optimal Performance Observed for COUNT Aggregate

Rdb 7.3.3 Bugs Fixed - SQL

- Unexpected Favoring of the First Storage Area When Using FILL RANDOMLY Clause
- VARIANCE Now Returns Zero for Single Row Groups for ORACLE Dialects
- SQL IMPORT DATABASE Does Not Restore THRESHOLDS for LIST Storage Map
- Unexpected ACCVIO When Using INSERT ... RETURNING Statement
- Unexpected RDB−F−REQ_WRONG_DB Error Reported by SHOW TRANSACTION
- Unexpected RDB−E−SEQNONEXT When Assigning DEFAULT to an IDENTITY

Rdb 7.3.3 Bugs Fixed – SQL (cont.)

- Unexpected Bugcheck When Executing Query With MIN, MAX or COUNT Function
- SQL Precompiler Not Setting Exit Status When INCLUDE File Missing
- RMU Dump Audit Always Assumed Type=ALL Even When Audit Classes Were Specified
- Unexpected Failure When WITH Clause Used With UNION Operator
- Incorrectly Generated Routine Prototypes for Internal Calls in C++
- Unexpected Value Inserted for Incorrect GUID Literal Value
- Unexpected RDB−E−OBSOLETE_METADA and RDMS−E−MODNEXTS Errors
- Correction to Error Reporting of Database Not Yet Open

Rdb 7.3.3 Bugs Fixed – RMU

- Handling RMU−F−AIJSEQAFT Error When Starting Continuous LogMiner
- Unexpected RDMS−E−BAD_CODE Reported When Using RMU Load to a LOCAL Temporary Table
- RMU/BACKUP/AFTER_IMAGE/FORMAT=NEW_TAPE AIJ Sequencing Problem
- Unexpected Bugcheck From RMU Verify Constraints
- Unexpected Area Corruption After RMU Move_Area of a UNIFORM Format Area

Rdb 7.3.3 Bugs Fixed – Other Areas

- LogMiner:
  - LogMiner Extracts Incorrect TSN Values From After Image Journal
- RMU Show Statistics
  - RMU SHOW STATISTICS Screen Did Not Display No Cluster Support Warning
- Rdb SGA API
  - RMUST_CT_LAPMS_STATS Class Returned Incorrect RMUST_T_LOGICAL_AREA_ID Value
  - RMUST_CT_LAPMS_STATS Class Returned Statistics for Unused Logical Areas

Rdb 7.3.2.1 New Features and Enhancements

- Optimizer Min Max and Count Optimizations
- Truncate Table Enhancement
- New MEDIAN aggregate function added to SQL
- RMU/RECLAIM
- Error Messages Returned from a Remote Database Engine Can Be Logged
- RMU/SHOW AFTER_JOURNAL [NO]CHECKPOINT Qualifier
- New RMU/BACKUP/AFTER_JOURNAL [NO]SPACE_CHECK Qualifier
- New Options to SET SQLDA Statement
- New RMU Set Statistics Command

Rdb 7.3.2.1 Bugs Fixed

- Unexpected Error when Using Multischema Domain Reference
- Unexpected USERNAME Written to After Image Journal for Notational Record
- RMU Unload After_Journal Now Detects Attempt to Unload Vertically Partitioned Table
- DBR Fails to Write START_TAD Record For Logminer
- HANG ON 7.3.2 When Using Translate and UTF8
- Unexpected Query Failure of INVALID_BLR when Using GROUP BY
- New Information Table RDB$SESSION_PRIVILEGES Now Available
- Unexpected COSI-F-VASFULL Error when TRUNCATE Used on Table with LIST Columns

Rdb 7.3.2.1 Bugs Fixed (cont.)

- Wrong Results from Statistical Functions MAX
- Wrong result in COUNT (expr) Function Using Multi-Segment Index
- Unexpected Bugcheck when Updating a SORTED RANKED Index
- Remote Connections No Longer Does Retry Using Old Protocol

Rdb 7.3.2.1 Update 1, June, 2017

- Fixed a problem where the distribution of List of Byte Varying (Blob) data across partitioned storage areas was incorrectly favoring the first storage area.
  - The FILL RANDOMLY clause of the LIST storage map would not distribute LIST OF BYTE VARYING columns uniformly.
- Fixed a problem where multiple bugchecks where occurring from SELECT using MIN and MAX functions.
- See MOS Patch 26273409 for Itanium
- See MOS Patch 26273393 for Alpha

Rdb 7.3.2.1 Update 2, September, 2017

- Unexpected RDB-E-BAD_DPB_CONTENT Error During Database ATTACH
  - Third party application was passing an illegal value in the database parameter block
  - Error was now being caught by Rdb V7.3 and later versions
- Possible Wrong Results From Partitioned Indices
  - From a query when using constant complex value expressions for the selection criteria that matched index columns used for partitioning.
- See MOS Patch 26820763 for Itanium
- See MOS Patch 26820751 for Alpha

Rdb 7.3.2.1 Update 3, November, 2017

- RMU Backup Incremental would incorrectly skip updated pages when both Row Cache and Incremental Backup Scan Optimization were enabled
  - Incremental Backup Scan Optimization is the default setting for new databases
  - Allows RMU Backup Incremental to skip SPAM pages not changed since last FULL backup
  - In rare cases the RCS (Row Cache Server) might ckeckpoint rows to the database and mark them with a TSN that is older than that recorded for the FULL database backup.
  - This indicated to RMU Backup Incremental that these rows need not be backed up
- See MOS Patch 27076089 for Itanium
- See MOS Patch 27076080 for Alpha

Rdb 7.3.2 Update 4, March, 2017

- Fixed a problem where the distribution of List of Byte Varying (Blob) data across partitioned storage areas was incorrectly favoring the first storage area.
  - The FILL RANDOMLY clause of the LIST storage map would not distribute LIST OF BYTE VARYING columns uniformly.
- See MOS Patch 25800744 for Itanium
- See MOS Patch 25800717 for Alpha

Rdb 7.3.3.0, Documentation Update

- Rollup release notes to RDB_NEWFEATURES document
  - Included on each kit (.pdf, .txt, .ps)
  - SYS$HELP:RDB_NEWFEATURES_73xx.PDF
- Rollup new features into documentation
  - Revised SQL Reference Manual ** Released September, 2016!
  - Revised RMU Reference Manual ** Released September, 2016!
- Generated new HELP for RMU and SQL
- New RMU/SHOW LOGICAL support
  - Documents logical names

Connectivity: Most Recent Releases

- Oracle SQL/Services
- OCI Services for Oracle Rdb
- Oracle ODBC Driver for Rdb
- Oracle JDBC for Rdb
- Oracle Rdb Connectivity Management (ORCM)
- Oracle Rdb Developer Tools (ORDT)

Oracle SQL/Services 7.3.2.3, March, 2017

- New and Changed Features for Oracle SQL/Services Client API
  - Sample Application Enhanced to Supply Alternate TCPIP Port
  - The kit is available on MyOracleSupport as patchset numbers 25690909 (HP-UX 64-bit), 25690917 (Linux 32-bit), 25690927 (Linux 64-bit), 25690929 (Microsoft Windows 32-bit) and 25690939 (Microsoft Windows 64-bit).
- New and Changed Features for OCI Services for Oracle Rdb
  - Add SESSION_PRIVS to OCI Services Tables
  - Computed Select Item Names
- Software Errors Fixed in OCI Services for Oracle Rdb
  - Incorrect Values Sometimes Stored in Date Columns
  - Update Across a Dblink ORA-01861: Literal Does Not Match Format String
  - ORA-03115 Returned After an UPDATE...RETURNING Statement
  - Wrong Values Inserted When Using Bind Variables and Scaled Integers
  - Alter Session Set NLS_TIMESTAMP_FORMAT Not Working if Called From Init File

Oracle ODBC Driver for Rdb 3.3.2.5, April, 2017

- Memory allocation failures and invalid results returned if API call includes the "REMARKS" column
- Incorrect value returned for SQLGetInfo(SQL_FORWARD_ONLY_CURSOR_ATTRIBUTES2)
- SQLGetDiagField (SQL_DIAG_CURSOR_ROW_COUNT) now returns SQL_SUCCESS with a value of -1 instead of SQLError
- SQLGetDiagField no longer returns -100 on record 0
- SQLGetDiagField now returns a 64 bit result as needed for SQL_DIAG_CURSOR_ROW_COUNT and SQL_DIAG_ROW_COUNT

Oracle ODBC Driver for Rdb – Prior Releases

- 3.3.2.4, October, 2014
- 3.3.2.3, April, 2012
- 3.3.2.2, November, 2011
- 3.3.2.1, April, 2011
- Supported Windows
  - Windows 32bit
    - Windows 7, XP, Vista, Server 2008, Server 2003, 2000,
  - Windows 64bit
    - Windows 7 XP, XP X64, Vista X64, Server 2008 X64, Server 2003 X64

Oracle JDBC for Rdb 7.3.5.1, March, 2018

- Download from My Oracle Support
  - Patch 27638830 for Itanium
  - Patch 27638813 for Alpha
- Features
  - A Pool Balancing option **PoolOrder** that tells the pool server to select the first pooled server in the pool that has not yet reached its maximum client limit instead of using the default round-robin search.
  - Additional Connection options
- Bug Fixes:
  - Incorrect Date/time Values when Timezones Mismatch
  - New Feature Omission - TimeZone Connection Attributes
  - Incorrect Parameter Initialization in RDBJDBC_EXECCLI.COM

Oracle JDBC for Rdb 7.3.5.1, March, 2018 (Cont.)

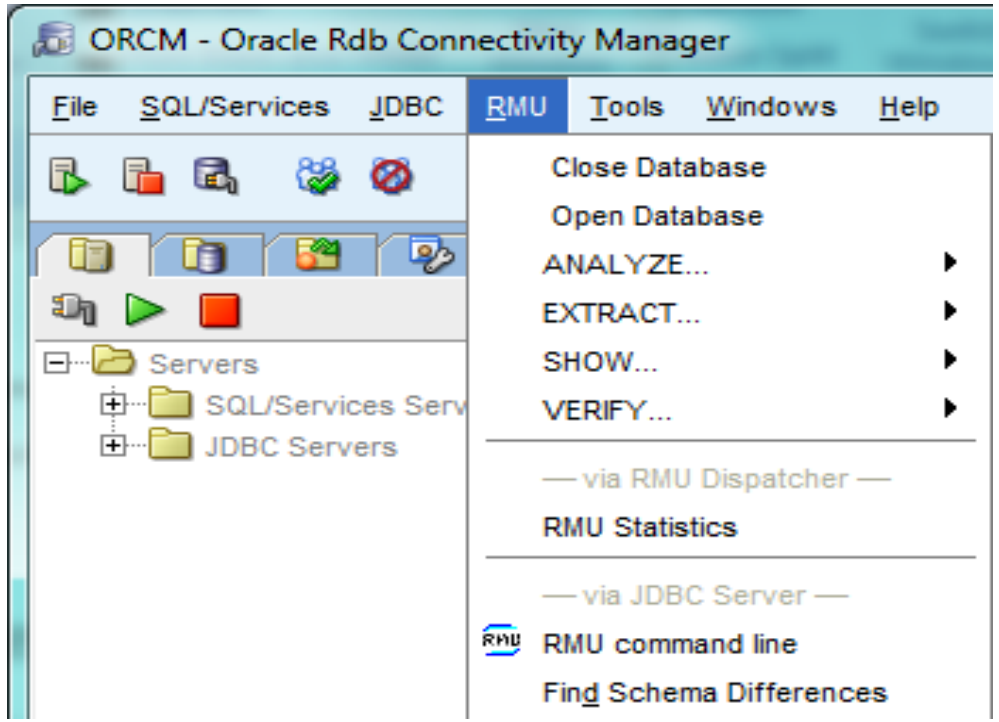
- Bug Fixes:
  - Spurious Error Message with Stop Client
  - ORCM Async External Tool Command Failure
  - Incorrect Seconds when Date Prior to JAVA Epoch
  - Multithread Problem with DatabaseMetaData
  - NLSLANG problems
  - RDBJDBC_STARTSRV.COM problem
  - More Incorrect Seconds when Date Prior to JAVA Epoch
  - SQL92 Dialect Semantics
  - Unreferenced CALL Parameters
  - ACCVIO when using CREATE or DROP DATABASE
  - IF EXISTS Trimmed off DROP Statements
  - NOSUCHCUR error when using ORDP
  - Concurrent Threads in single Connection

Oracle JDBC for Rdb 7.3.5, August, 2017

- Download from My Oracle Support
  - Patch 26630544 for Itanium
  - Patch 26630533 for Alpha
- Features
  - JAVA 8.0 support on Integrity Systems
  - Versioned JDBC driver jars
  - Change in SQL/Services JDBC Dispatcher naming
  - Changes to SHIFT_JIS JAVA encodin
- Bug Fixes:
  - Small Memory leak with GetTables()
  - DEFAULTSSL definition not inherited
  - Incorrect value for Client and Executor Free Shared Memory

ORCM 7.3.2, August, 2017

- Download from My Oracle Support
  - Patch 26667279 for Windows
  - Patch 26667304 for Generic Kit
- Features
  - New RMU Menu category
  - RMU Statistics
  - Find Schema Differences
  - External Tool Enhancements
- Bug Fixes:
  - Small Memory leak with GetTables()
  - DEFAULTSSL definition not inherited
  - Incorrect value for Client and Executor Free Shared Memory



Oracle Rdb Developer Tools

- 7.3.6, March, 2018
  - Available for download from My Oracle Support
    - Patch 27647428
    - Also available on OTN at: http://www.oracle.com/technetwork/database/database-technologies/rdb/downloads/othersoft-087176.html.
  - Features:
    - Visual Studio 2017 Integration
  - Bugs Fixed
    - Entity Framework6 internal SQL queries returning string truncation error

Oracle Rdb Developer Tools (cont.)

- 7.3.5, July, 2016
  - Available for download from My Oracle Support
    - Patch 24334756
  - Features:
    - Visual Studio 2015 Integration

Oracle Rdb Developer Tools (cont.)

- 7.3.4, June, 2015
  - Available for download from My Oracle Support
    - Patch 21313157
  - Features:
    - Visual Studio 2013 Integration
    - Entity Framework 6 Supported
    - Entity Framework fluent API Supported

Other Oracle Rdb Family Products: Latest Versions

- Oracle CDD/Repository
- Oracle Rdb Extension for SQL Developer

Oracle CDD/Repository 7.2.0.6.0, July, 2015

- Available on My Oracle Support
  - Patch 21488004 for Itanium
  - Patch 21488027 for Alpha.
- Problems Fixed:
  - Problem when changing a relation with constraints when on OpenVMS 8.4-1H1 Systems.

Oracle Rdb Extension for SQL Developer Release 7.3.3.0, May, 2018

- Features
  - Allows you to run with SQL Developer 17.4.0.355 and 4.1.3
- Download from My Oracle Support
  - Will be made available on MOS shortly
- Requirements:
  - Oracle JDBC for Rdb release 7.3.4.0.4

Oracle Rdb Extension for SQL Developer Release 7.3.2.0, December, 2015

- Download from My Oracle Support
  - Patch 22294391
- Features
  - Allows you to run with SQL Developer 4.1.2
- Requirements:
  - Oracle JDBC for Rdb release 7.3.4.0.4

Oracle Rdb: What's Under Development

Database Vault

- Changes the way Rdb handles OpenVMS privileges
- `ALTER DATABASE …`
  `DATABASE VAULT IS ENABLED;`
- Requires SECURITY privilege to enable
- No longer inherit overrides from current system user
- *WARNING* Ensure there is a SECURITY user defined in the database because once DATABASE VAULT is enabled you can not use a OpenVMS privilege to change it externally

Oracle SQL/Services and OCI Services 7.3.3.0

- Support for Oracle 11g Libraries and Oracle 11g Oracle Net Protocol
- OCI Authentication Today
  - Currently users are defined in the USER$ table
  - We store an encoded password (different encoding to that used by OpenVMS and LDAP servers)
  - This password is used to authenticate with the Oracle server
  - RDB$NATCONN_CUPP Utility used to add, modify, remove, and show users enabled for OCI access and to sync with updated VMS passwords
- OCI Authentication with LDAP
  - Specify the password "GLOBAL", indicates (as it does for Oracle users) that authentication will be done using LDAP
  - Users with the password "GLOBAL" in the USER$ table will be authenticated using the LDAP directory defined in LDAPACME$INIT, the same LDAP directory used by Rdb for external authentication

Oracle SQL/Services and OCI Services 7.3.2.4

- SQL Services Authentication using LDAP Username/Password
- OCI time zone compatibility fix
  - Issue occurred because Rdb does NOT support Oracle time and timestamp data types with time zone
- Added ‘DECLARE TRANSACTION’
  - Databases with "SECURITY IS INTERNAL" could not be prepared for OCI Services without it.
- Allowed Oracle conversion functions to be run without OCI Services.
  - Functions are: TO_CHAR, TO_DATE, TO_NUMBER, TO_ROWID, ROWID_TO_CHAR, TO_TIMESTAMP, DATE_ROUND, DATE_TRUNC

Oracle SQL/Services and OCI Services 7.3.2.4 (Cont.)

- MLOG$ and V$LICENSE tables
  - Added these tables as part of PREPARE in response to a customer bug where MS SQL/Server 2016 using SSMA utility didn't connect because these 2 tables were missing
- MLOG$ Information about activity related to materialized views
- V$LICENSE Information about current limits of license settings, number of sessions, maximum number of users, cpu and cpu core counts

* NOTE: Neither Rdb nor OCI Services inserts rows into either of these tables

Oracle CDD/Repository 7.3.0

- Customer Driven Enhancements
  - Adding Rdb SQL Features not Previously Supported:
    - Can now integrate into CDD a database that has been prepared for OCI Services
    - Coalesce
      - returns the first non-NULL value from a series of value expressions; otherwise, returns NULL
    - Other capabilities to be added based on demand

Oracle Trace 7.3.0

- Updating the BLR translator to the 7.3.3 BLR level
  - Will allow Trace to understand new features such as the Trim and Rtrim functions
- Bug Fix: Error condition that wasn't handled correctly when an RUJ file could not be accessed or was improperly specified.
  - Result was a an ACCVIO and Bugcheck

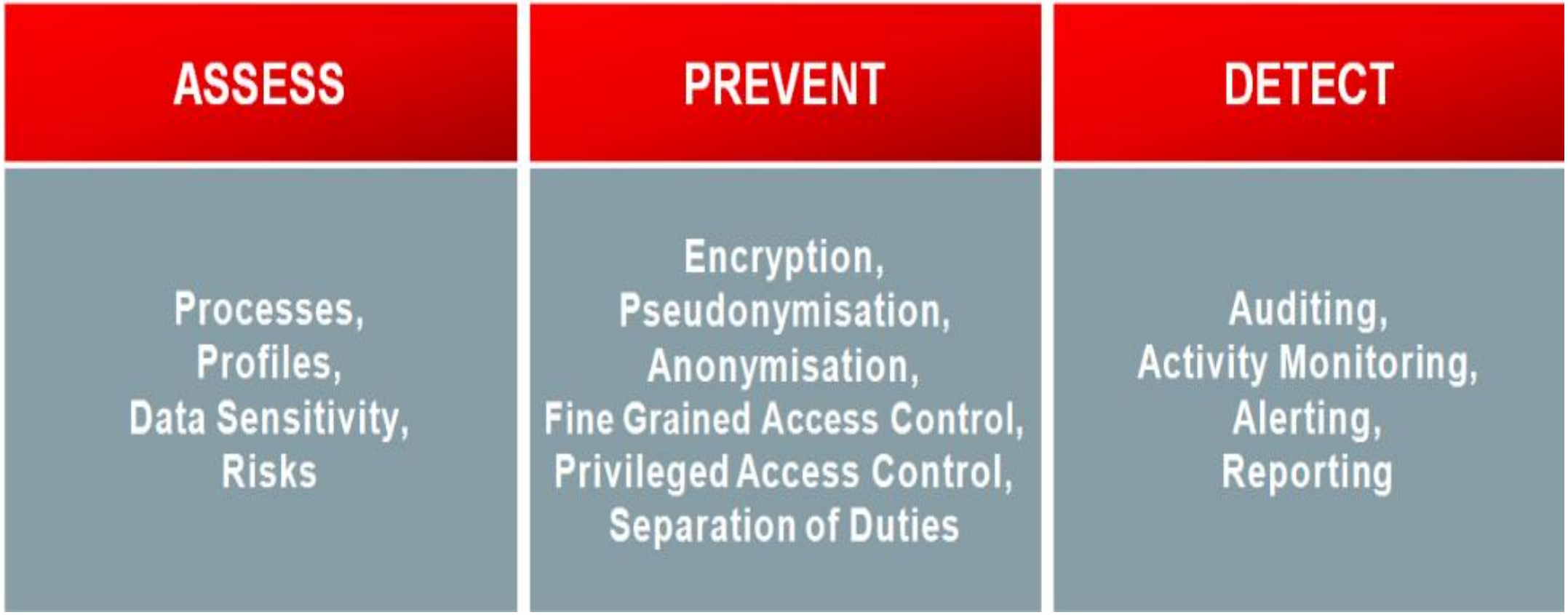
Oracle Replication Option (ROR) 7.3.0

- Bringing ROR up-to-date with new Rdb 7.2 and 7.3 features
  - Currently some tables can’t be replicated due to lack of support for features such as Identity Columns

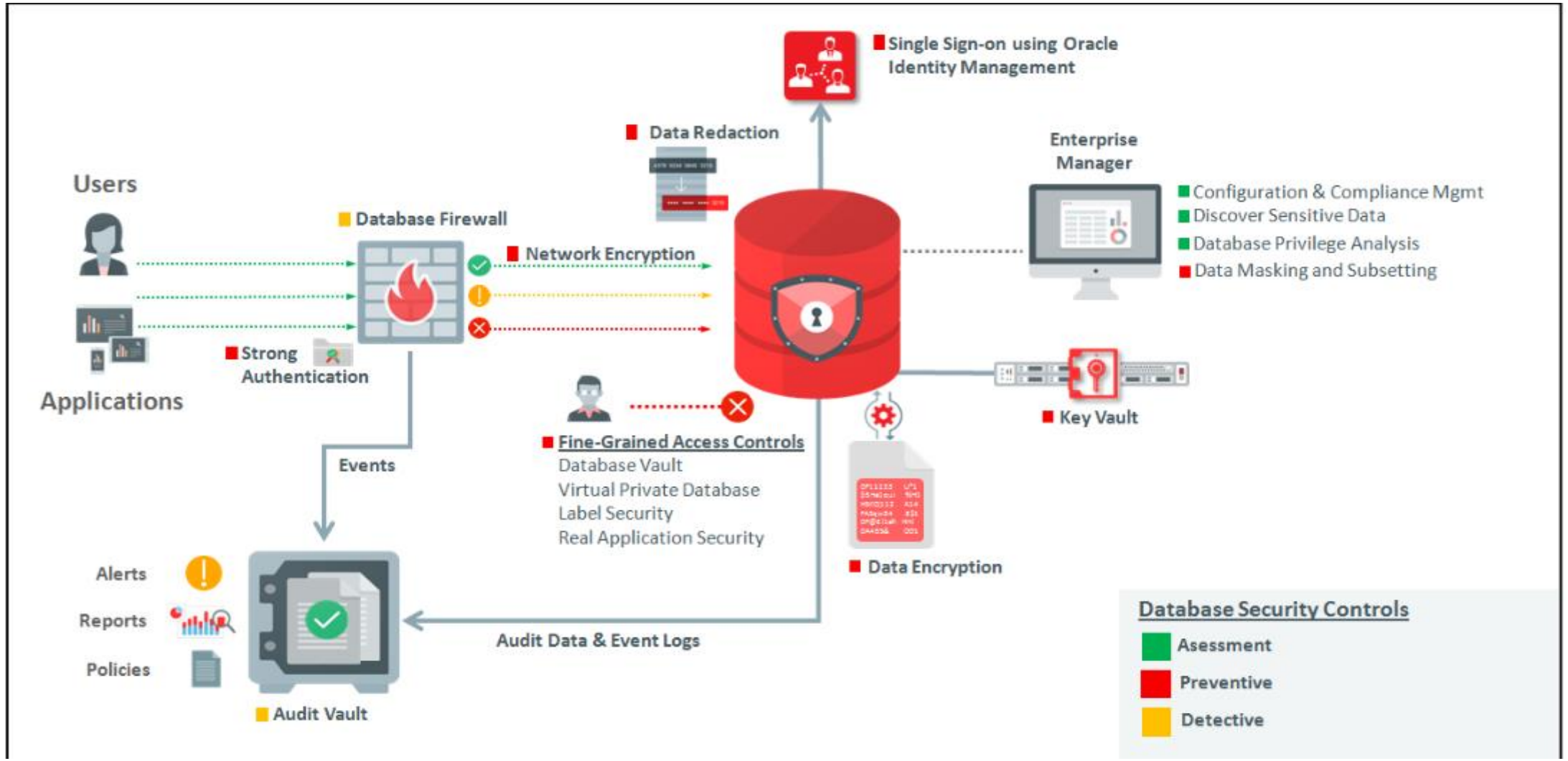
Oracle ODBC Driver for Rdb 3.3.2.6

- Built on Visual Studio 2010
- New Help File
- Workaround for OpenText BIQuery (Memory Access Violation when SQLSetStmtAttr(SQL_ATTR_MAX_LENGTH) is set to 4294967295
- Functionality to redirect ODBC driver logs to a specific location

GDPR



GDPR: Oracle Maximum Data Security Architecture



Oracle GDPR White Papers

- See:
- http://www.oracle.com/technetwork/database/security/wp-security-dbsec-gdpr-3073228.pdf?customTrackingParam=&source=:ow:o:s:mt:TPJANWU1&intcmp=:ow:o:s:mt:TPJANWU01
- http://www.oracle.com/us/products/database/data-masking-best-practices-161213.pdf
- http://www.oracle.com/technetwork/database/options/data-masking-subsetting/overview/ds-security-dms-2245926.pdf

Oracle CODASYL DBMS 7.3.2.0 – Bug Fixes

- Fix DBO/VERIFY IA64 alignment faults.
- Bugcheck at DIOFETCH$FETCH_SNAP_SEG
- DBMDBRBUG Bugcheck at RUJUTL$BIJBL_GET_FORWARD + 1E0
- DBO/SHOW STATISTICS Playback Zeroed Final Transaction Duration
- Field help missing for some DBO/SHOW Statistics fields
- Possible Misleading Messages From DBO/RECOVER/JUST_CORRUPT
- DBO/BACKUP/MULTITHREAD Did Not Output the VMS RMS STV Status for Errors Opening Storage Areas
- Lack of LRS reply status on HOT STANDBY shutdown
- Master ALS Restart Does Not Resume Updating Standby Database
- RMU/RECOVER Bugcheck Dump Caused by OpenVMS SYSTEM-W-NONLOCAL
- MONITOR BUGCHECKS WHEN RUNNING DBO/CLOSE/STAT=EXPORT

Oracle Message Queue Update

- OMQ 5 on OpenVMS 8.4-2 (IA) Certified (August, 2016)
- See http://docs.oracle.com/cd/E17973_01/platforms/mqplatforms/mqplats/mqplats.html#wp1087062

Training Partner List

- **Europe, Asia, Middle East and Africa**
  - VX Company
    Baarn, The Netherlands
    http://www.vxcompany.com/rdbtrainingcourses
- **Americas**
  - JCC Consulting, Inc.
    Granville, Ohio, United States
    http://www.jcc.com/
- **Oracle CODASYL DBMS Worldwide**
  - Software Concepts International
    Nashua, New Hampshire, United States
    http://www.sciinc.com/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Recent Developments in Oracle Rdb

Ian Smith
Consulting Member of Staff
Oracle Corporation

ORACLE

Optimizer Enhancements

Query Rewrite

Ongoing improvements to the query compiler

Query Rewrite: Recap

- New query rewrite engine in V7.3
- Make use of nullability knowledge to simplify query
  - Evaluates known not nullable expressions during query compile
  - Knowledge based on constraints
    - **not null not deferrable**
    - **primary key not deferrable**
- Eliminates always TRUE and FALSE predicate branches
  - Also applied to CASE statement WHEN Boolean expressions
- Computes integer and floating literal expressions at compile time
- Eliminate constant values from ORDER BY, DISTINCT, UNION DISTINCT, etc.

Query Rewrite: Date/Time

- Recognize run-time functions and convert to compile-time evaluation
- CAST(string AS TIMESTAMP(n))
  CAST(string AS DATE ANSI)
  CAST(string AS DATE VMS)
  Convert string to binary date/time during compile
- e.g. CAST('2017-1-1' AS DATE) replaced with literal **date**'2017-1-1'
- CAST(integer AS INTERVAL …)
  If single field interval-qualifier, replace with interval literal

Query Rewrite: Date/Time

- Recognize date ANSI expressions
  … where cast(posting_timestamp as date) = date'value'
- Here the query wants all timestamps for a specific date
  but CAST hides the index column **posting_timestamp** from the optimizer
- Query rewrite changes it to:
- **… where posting_timestamp >= date'value' and**
  posting_timestamp < date'value' + interval'1' day
- Now the column is exposed in a range query

Query Rewrite: BITMAP SCAN and <>

- When bitmap scan is enabled, transform not equal to range query
- e.g. columnname <> value
  becomes
  columnname < value **or** columnname > value

Query Rewrite: String comparisons (V7.3.3)

- Expanded expression compare for strings
- Must have identical character sets
- Evaluated during compile time:
  - Equals
  - Not equals
  - Greater than
  - Less than
  - Greater or Equal than
  - Less or Equal than

Aggregate Enhancements

Ongoing improvements to the query compiler

COUNT optimization

- Recap: SORTED RANKED index
- COUNT aggregates
  - COUNT(*)
  - COUNT(ALL column)
  - COUNT(DISTINCT column)
- Solved by using special **count scan** optimization
  - Saves CPU time
- Don’t need list of DBKEYs, just the count
- Computed from leaf node cardinality values

New: COUNT optimization

- Observed that similar savings could be made for SORTED indices
- Must do I/O to duplicate node chains
- Still has huge benefit as count is computed deeper in kernel
- Rather than counting returned DBKEY values
- …some tests show 15% lower CPU usage
- Results will vary based on index and query

Multi-Aggregate Optimization

- Recap: existing index optimizations are:
  - **Min key lookup**
  - **Max key lookup**
  - **Index counts** (sorted), and **Index counts lookup** (sorted ranked)
  - **Index distinct** (sorted), and **Index distinct lookup** (sorted ranked)
- These are applied to:
  - MIN (index-column), MAX (index-column)
  - COUNT(*), COUNT (index-column), COUNT (DISTINCT index-column)
- …but only applied to **if one** aggregate function used

Multi-Aggregate Optimization (7.3.2.1)

- Optimizations now applied to all candidate aggregate functions
- Reduces I/O and CPU usage for the query
- Applied even when aggregates combined in expressions
- e.g. Range calculation: MAX (v) – MIN (v)

Old Strategy

Requires full scan

```
SQL> select min (salary_amount), max (salary_amount), count (salary_amount)
cont> from salary_history;
Tables:
  0 = SALARY_HISTORY
Aggregate: 0:MIN (0.SALARY_AMOUNT) Q2
           1:MAX (0.SALARY_AMOUNT) Q2
           2:COUNT (0.SALARY_AMOUNT) Q2
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_NDX [0:0]

   $7,000.00    $93,340.00                    729
1 row selected
SQL>
```

New Strategy

```
SQL> select min (salary_amount), max (salary_amount), count (salary_amount)
cont> from salary_history;
Tables:
  0 = SALARY_HISTORY
Aggregate: 0:MIN (0.SALARY_AMOUNT) Q2
           1:MAX (0.SALARY_AMOUNT) Q2
           2:COUNT (0.SALARY_AMOUNT) Q2
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_NDX [0:0]   Min key lookup
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_NDX [0:0]   Max key lookup
Index only retrieval of relation 0:SALARY_HISTORY
  Index name  SALARY_NDX [0:1]   Index counts
    Keys: NOT MISSING (0.SALARY_AMOUNT)

   $7,000.00    $93,340.00                    729
1 row selected
SQL>
```

Uses several optimized scans

Temporary Tables

- Now supports LARGE MEMORY option
- Rows and data structures reside in P2 space (64 bit memory)
- Frees up P0/P1 space for applications
- New clause for:
  - Create local temporary table
  - Create global temporary table
  - Declare local temporary table (V7.3.2)

Changes: TRUNCATE TABLE (V7.3.2)

- The SQL Database Language Standard defines new behavior and new syntax
- **restart identity** and **continue identity** clauses
- Previously **truncate table** would always **restart identity** (reset to the initial value)
- SQL dialects (SQL2011, and future) will default to **continue identity**

New: Truncate Table … continue identity

```
SQL> truncate table ACTIVITY_LOG continue identity;
SQL>
SQL> show sequence ACTIVITY_LOG;
     ACTIVITY_LOG
 Sequence Id: 9
 An identity column sequence.
 Initial Value: 1
 Minimum Value: 1
 Maximum Value: (none)
 Next Sequence Value: 1001
 Increment by: 1
 Cache Size: 20
 No Order
 No Cycle
 No Randomize
 Wait
 Comment:      column IDENTITY sequence
SQL>
```

Generated Columns - Background

- Rdb V1.0
- Supported COMPUTED BY columns
  - Virtual
  - Take just 1 in null bit vector in row
  - Always a read-only column
- Evaluated during **select**, or in **where** clauses for **update** and **delete** statements

Generated Columns

- Rdb V7.1
- Supported AUTOMATIC columns
  - Automatic insert as …
  - Automatic update as …
  - Automatic as ...
- Use space in a row
- Data type derived from value expression
- Evaluated on **insert** and/or **update** statements
- Act like read-only columns, but Rdb stores data

Generated Columns - Identity

- Rdb V7.1
- IDENTITY
  - Based on CREATE SEQUENCE feature
  - Special sequence created; same name as table
  - Therefore, at most one per table
  - Looks like AUTOMATIC AS tablename.NEXTVAL
- Uses space in row
- Column can be given a data type (or domain)
- Acts like read-only column; but Rdb stores data

Generated Columns

- Database administrator may want to insert rows which have values for these types of columns
  - Sometimes these columns need correction
  - Might want to reload the table without re-computing values
- Provide SET FLAGS ‘AUTO_OVERRIDE’
  - Allows privileged user (DBADM) to manage updates
- Restructure and reload supported by RMU
  - RMU/LOAD/VIRTUAL_FIELDS=AUTOMATIC
  - SET FLAGS not required in this case

Generated Columns – New Syntax (V7.3.3)

- Based on ANSI/ISO SQL, and Oracle Database language
- Syntax maps to AUTOMATIC and IDENTITY implementation
  - GENERATED ALWAYS AS (value-expression)
  - GENERATED ALWAYS AS IDENTITY
- New: can specify domain or data type for column

Generated Columns (V7.3.3)

- Also supporting new functionality
  - GENERATED **BY DEFAULT** AS IDENTITY
  - GENERATED **BY DEFAULT** AS (value-expression)
- These types of generated columns can be updated by the application
- If a value is inserted, then no automatic generation will take place
- No privileges or use of AUTO_OVERRIDE required

Generated - Example

The data type is optional. Implicit CAST performed when specified.

```
SQL> create table EMPLOYEES
cont> (badge_num integer generated always as identity (cache 100)
cont> ,last_name varchar(40)
cont> ,first_name varchar(40)
cont> ,created_date generated always as ( current_date )
cont> ,created_by generated by default as ( current_user )
cont> );
```

Generated Columns - Identity

- Any GENERATED BY DEFAULT AS IDENTITY column can be manually updated
- Inserted/updated values should be within the range of the sequence
- Rdb can no longer guarantee unique values
- Collisions must be handled by the application

Generated Columns – DEFAULT (V7.3.3)

- Now allow **default** keyword assignment to AUTOMATIC, IDENTITY, GENERATED ALWAYS and GENERATED BY DEFAULT columns

```
SQL> !! These two statement should be equivalent
SQL> insert into SAMPLE1 default values;
1 row inserted
SQL> insert into SAMPLE1 (employee_id, birthday, last_name)
cont>     values (default, default, default);
%RDB-E-READ_ONLY_FIELD, attempt to update the read-only field
EMPLOYEE_ID
SQL>
```

New and Improved Built-in Functions

Oracle Database and ANSI/ISO SQL Language support

TRIM optimizations (V7.3.2)

- TRIM function is based on ANSI/ISO SQL syntax
- Really three separate function
  - TRIM (LEADING …)
  - TRIM (TRAILING …)
  - TRIM (BOTH …)
- Now implemented for most character sets as separate functions
- Reduced code path for normal usage

LTRIM and RTRIM

- Supported in prior versions in the SQL_FUNCTIONS library
- Limited character set support
- Fixed size result; always VARCHAR(2000)
- Common usage through Oracle tools and OCI Services for Rdb

LTRIM and RTRIM

- New native support in Oracle Rdb
- Supports Oracle Database null semantics
- Polymorphic (adapts to character set and length)
- Lower overhead in queries
- Similar to TRIM function but trim any of the characters in the trim-string
- Access to older versions will revert to SQL_FUNCTIONS equivalents
  - SQL Module Language or SQL Pre-compiler applications require recompile to use new implementation

LISTAGG

- Allows values in the group to be concatenated to a single value
- Best explained with examples

LISTAGG

EMPLOYEE_ID	SALARY_START	SALARY_END	SALARY_AMOUNT
.			
.			
.			
00369	1982-06-02	NULL	$57,410.00
00374	1978-10-23	1979-08-19	$43,310.00
00374	1979-08-19	1980-01-18	$45,427.00
00374	1980-01-18	1981-01-12	$47,732.00
00374	1981-01-12	1981-10-15	$47,919.00
00374	1981-10-15	1982-10-10	$50,424.00
00374	1982-10-10	NULL	$50,424.00
00405	1975-07-01	1976-02-26	$27,554.00
.			
.			
.			

Group by EMPLOYEE_ID

Group 00374

LISTAGG

LISTAGG
(salary_start)

EMPLOYEE_ID	SALARY_START	SALARY_END	SALARY_AMOUNT
.			
.			
.			
00369	1982-06-02	NULL	$57,410.00
00374	1978-10-23	1979-08-19	$43,310.00
00374	1979-08-19	1980-01-18	$45,427.00
00374	1980-01-18	1981-01-12	$47,732.00
00374	1981-01-12	1981-10-15	$47,919.00
00374	1981-10-15	1982-10-10	$50,424.00
00374	1982-10-10	NULL	$50,424.00
00405	1975-07-01	1976-02-26	$27,554.00
.			
.			
.			

LISTAGG

- Other aggregates have a known data type and size result
- MEDIAN, MAX, MIN reflect the input values
- AVG, STDDEV, VARIANCE always DOUBLE PRECISION
- COUNT is an integer (int or bigint)

- How long is long is the LISTAGG result?
- Defaults to VARCHAR(4000) result but is user settable

LISTAGG

- Accepts columns from the group
- Can define a separator string for the list
- Includes an ORDER BY clause to arrange ordering of the result string
  - WITHIN GROUP (ORDER BY …)
- Can use DISTINCT
- Optional clauses to control action on string truncation
  - ON OVERFLOW ERROR
  - ON OVERFLOW TRUNCATE

LISTAGG

- What if group is large or result exceeds output buffer?

```
SELECT department_id,
    LISTAGG(last_name, '; ')
    WITHIN GROUP (ORDER BY hire_date) AS emps
FROM employees
GROUP BY department_id;
%RDB-E-CONCATTRUNC, data exception - string data, right
truncation for concatenate
-RDMS-F-TRUNRGTSTR, truncation of right-hand side string for
assignment has occurred
```

LISTAGG

- This is equivalent to ON OVERFLOW ERROR syntax

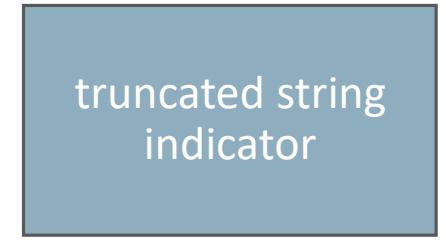
```
SELECT department_id,
    LISTAGG(last_name, '; ' ON OVERFLOW ERROR)
    WITHIN GROUP (ORDER BY hire_date) AS emps
FROM employees
GROUP BY department_id;
%RDB-E-CONCATTRUNC, data exception - string data, right
truncation for concatenate
-RDMS-F-TRUNRGTSTR, truncation of right-hand side string for
assignment has occurred
```

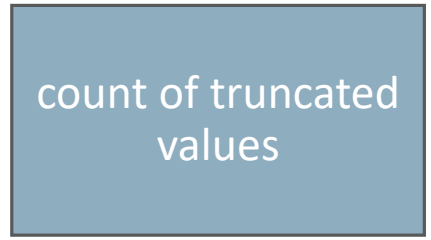
LISTAGG

- Can control behavior with ON OVERFLOW TRUNCATE

```
SELECT department_id,
    LISTAGG(last_name, '; '
      ON OVERFLOW TRUNCATE '...' WITH COUNT)
    WITHIN GROUP (ORDER BY hire_date) AS emps
FROM employees
WHERE department_id = 30
GROUP BY department_id;
 DEPARTMENT_ID   EMPS
            30   Clinton; Smith; Jackson; Crain; Clinton;
.
.
.
                 Crain; Clinton; Smith...(102)

1 row selected
```





GROUP_CONCAT

- MySQL has a similar function
- Maps directly to LISTAGG
- Implicit CONCAT of values when more than one specified

GROUP_CONCAT

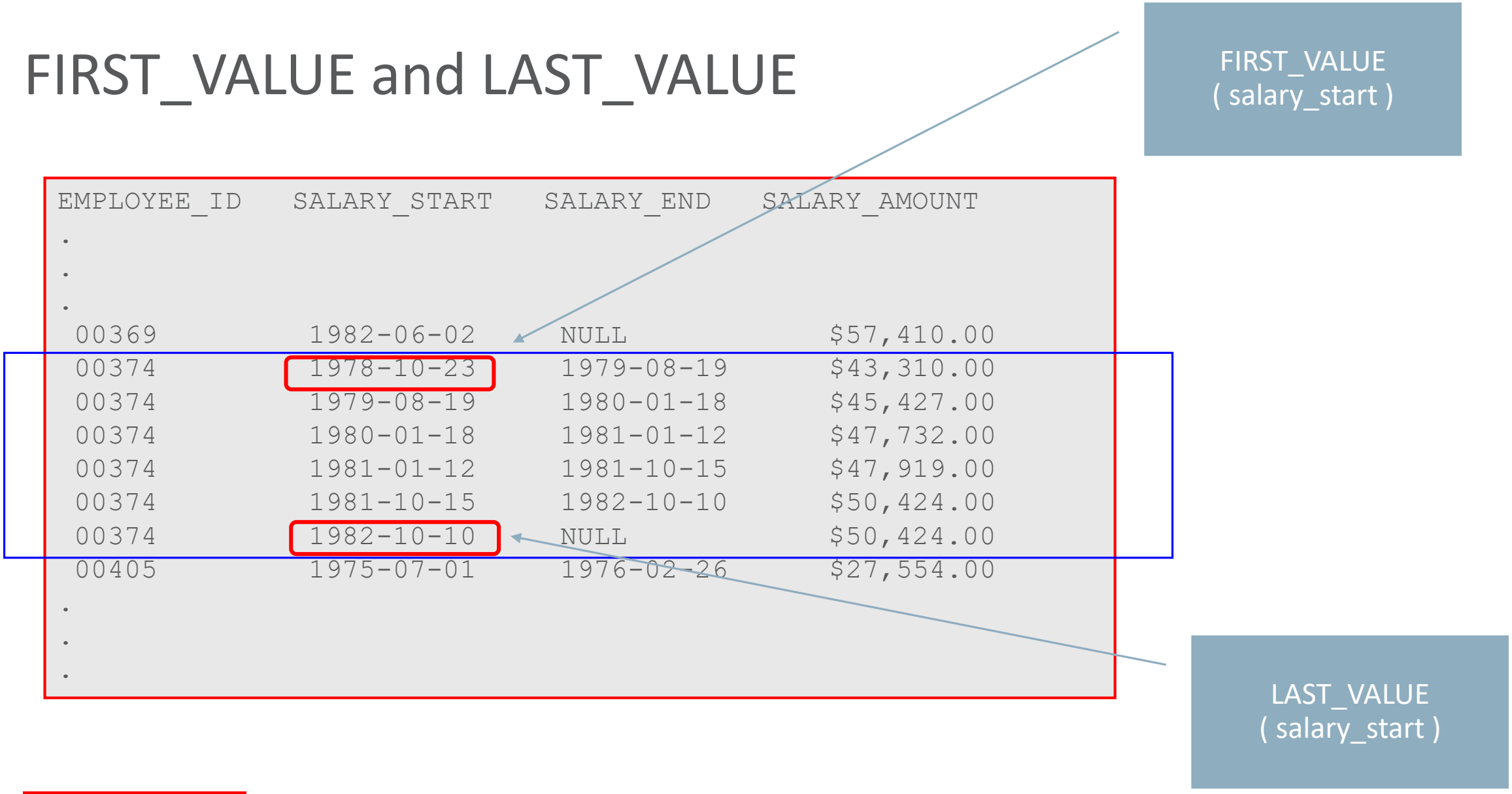
- Similar results to previous example

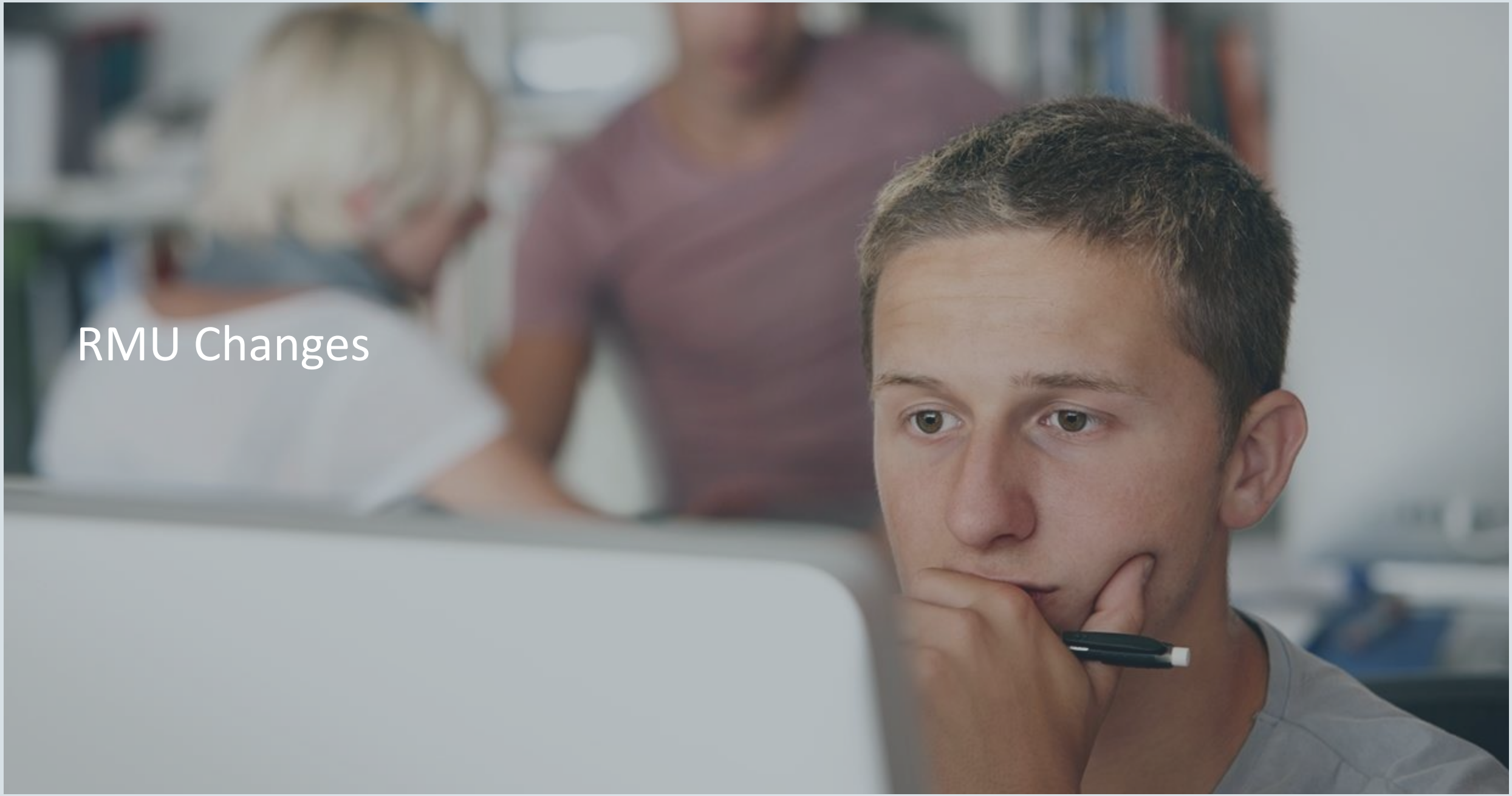
```
SQL> SELECT department_id,
cont>     GROUP_CONCAT (last_name
cont>                   ORDER BY hire_date
cont>                   SEPARATOR '; ') AS emps
cont> FROM module.employees
cont> GROUP BY department_id;
 DEPARTMENT_ID   EMPS
            30   Clinton; Crain; Jackson; Jackson;
.
.
.
```

FIRST_VALUE and LAST_VALUE

- Natural extensions from the LISTAGG project
- Uses the ordered set to select the **first** and **last** value
- Includes WITHIN GROUP (ORDER BY …) clause
- Not quite the same as MIN and MAX
- Positional values versus computation values

FIRST_VALUE and LAST_VALUE





Database Statistics

- Prior releases…
- Database statistics are discarded on RMU/CLOSE
- What if you want to conserve them across database shutdown?
- Can use RMU /Close /Statistics=EXPORT
  - Creates a .RDS which is a node specific dump of the statistics
- RMU /Open /Statistics=IMPORT
  - Restores the .RDS to active statistics section
- Also includes /Checkpoint to have the statistics periodically saved

Database Statistics

- What about databases set as OPEN IS AUTOMATIC?
- Added new RMU/Set Statistics command
  - Set and forget
  - Added database attributes to control behavior during OPEN and CLOSE
- Use RMU /Dump /Header to view settings
- Entries are also written to the monitor log file

RMU Set Statistics

- /Export
  Performs an immediate export of the statistics
  - /Export=CLOSE
    On database close the monitor will export the statistics
- /Export=NOCLOSE
  Disables the implicit export

RMU Set Statistics

- /Import=OPEN
  On database open the monitor will import statistics from .RDS
  - /Import=NOOPEN
    Disables the implicit import
- By default the .RDS will be maintained every 30 minutes with a fresh snapshot of the statistics (.RDS is revised)
- /Checkpoint=n
  Can be used to use more or less frequent updates to the .RDS
- /NoCheckpoint
  Disables this checkpointing

RMU Load

- Long standing wish for data type conversion controls in RMU Load
- For example,
  - A CSV file from an external source uses dates in various formats: 17/10/01, 10-Jan-2017
  - A source specifies numbers with 1000 separators 10,000.00, or European style 10.000,00
  - Customer wanted to insert DATE VMS with 7 digit factional precision
  - Treat specific value as a NULL, for example 0 might be considered as NULL

RMU Load

- New syntax for RECORD DEFINITION file (RRD)
- Database administrator can specify SQL routine for transformation of the data
  - STORE USING clause names the routine
  - The assumption is that the routine accepts at least 1 parameter
  - Note: allow routines that default unspecified parameters
- Routine must be a function defined in the database
- SQL or External
- Grant EXECUTE so that RMU Load users can execute routine

RMU Load

- SQL$SAMPLE includes a module of example routines
  - SQL$SAMPLE:CVT_MODULE.SQL
- These can be used directly, or used as the basis for your own
- We will add to these routines

RMU Load – Store Using

```
create module EXAMPLE
  function CONVERT_DECIMAL_MARK (in :v varchar(40))
  returns varchar(40)
  comment is 'Preserve digits and sign from the input, '
  /          'eliminate the digit group separator '
  /          'and substitute decimal mark';
  return translate (:v, ',.', '.');
end module;
```

RMU Load – Store Using Example

```
DEFINE FIELD EMPLOYEE_ID DATATYPE IS TEXT SIZE IS 5.
DEFINE FIELD SALARY_AMOUNT DATATYPE IS TEXT SIZE IS 30.
DEFINE FIELD SALARY_START DATATYPE IS TEXT SIZE IS 10.
DEFINE FIELD SALARY_END DATATYPE IS TEXT SIZE IS 10.
DEFINE RECORD SALARY_HISTORY.
   EMPLOYEE_ID .
   SALARY_AMOUNT store using CONVERT_DECIMAL_MARK.
   SALARY_START .
   SALARY_END .
END SALARY_HISTORY RECORD.
```

- One STORE USING per field
- As many for fields that need transformations

Rdb RMU/SHOW STATISTICS Zoom Screen Option

- Available For Logical Area Statistics Screen
  - Displays the top ten or fewer processes attached to an Oracle Rdb database that are accessing the table logical area currently displayed
  - User selects the statistic(s) to be used
    - "ALL" option uses the sum of all the statistics selectEd
  - The process ID will end with a colon followed by the stream ID assigned by the database
  - Only available for table logical areas

Example: Logical Area Statistics Screen with Zoom Option

Oracle® Rdb for OpenVMS

```
Rate: 3.00 Seconds                                  Logical Area Statistics
Page: 1 of 1                                DEVICE:[DIRECTORY]MF_PERSONNEL.RDB;1
.....................................................................................
                                                    Table EMPLOYEES in EMPIDS_LOW

statistic.........      rate.per.second.............. total....... average......
name..............      max..... cur..... avg....... count....... per.trans....

A. record marked                0        0        0.0           0           0.0
B. record fetched               1        0        0.5         222          74.0
C.     fragmented               0        0        0.0           0           0.0
D. record stored                0        0        0.0           0           0.0
E.    fragmented                0        0        0.0           0           0.0
F. pages checked                0        0        0.0           0           0.0
G.  saved IO                    0        0        0.0           0           0.0
H.  discarded                   0        0        0.0           0           0.0
I. record erased                0        0        0.0           0           0.0
J.  fragmented                  0        0        0.0           0           0.0
K. sequential scan              0        0        0.0           0           0.0
L.  record fetched              0        0        0.0           0           0.0
M. ALL

.....................................................................................
Type <return> or <letter> to select logical area statistics, <control-Z> to
  cancel
```

Example: Top 10 Processes for ‘Rcord Fetched’

```
Node: TSTNOD (1/1/16)                          Oracle Rdb V7.3-300 Perf. Monitor
Rate: 3.00 Seconds                                 Logical Area Statistics
Page: 1 of 1                                DEVICE:[DIRECORY]MF_PERSONNEL.RDB;1
.....................................................................................
                                                      Table EMPLOYEES in EMPIDS_LOW

 ...Top Processes Accessing Logical Area EMPLOYEES in EMPIDS_LOW.................
 .
 . top.............................statistic
 . processes.....................record fetched
 . 20B54CFC:1A                            12036
 . 20B3EB03:1A                            10347
 . 20ADC254:1A                            10321
 . 20A8CE4A:1A                             9560
 . 20B31240:1A                             8374
 . 20B5743A:1A                             7312
 . 20B39E2F:1A                             6543
 . 20A71A11:1A                             5478
 . 20AFC603:1A                             4312
 . 20B46D41:1A                             3245
```

New RMU/RECOVER Optimization

- All transactions must be recovered in the correct original sequence to prevent loss of data and database corruption
  - If the TSN number in the open record of an AIJ file is greater than the highest committed TSN number in the database root file, none of the transactions in the AIJ file will be recovered
- Previously, if the TSN of the AIJ open record was greater, RMU/RECOVER would read through the entire journal file, ignoring all transactions
- Now the recovery operation will be immediately aborted to avoid reading through the entire AIJ file and any additional AIJ files

New RMU/RECOVER Error Messages

- New ERROR Messages if the TSN of the AIJ open record was greater than the highest committed TSN number in the database root file
- Previous Error:
  - %RMU-W-NOTRANAPP, no transactions in this journal were applied
- New Errors output:
  - %RMU-F-BACKUPNOAIJ, After Image Journaling was enabled after the database was backed up or has since been disabled and reinitialized
  - RMU-F-CANTSYNCTSNS, Last committed TSN 96 in the after image journal file exceeds last committed TSN 35 in the database root
  - %RMU-F-TSNNOSYNC, The transactions in this journal file are not consistent with the transactions in this database root file

Example: Journals Enabled AFTER Last Full DB Backup

```
$ SQL
drop database filename foo.rdb;
exit
$ RMU/RESTORE/NOCDD/NOLOG BAR.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/LOG/TRACE FOO.AIJ
%RMU-I-LOGRECDB, recovering database file device:[directory]FOO.RDB;1
%RMU-F-BACKUPNOAIJ, After Image Journaling was enabled after the database was
 backed up or has since been disabled and reinitialized
-RMU-F-CANTSYNCTSNS, Last committed TSN 96 in the after image journal file
 exceeds last committed TSN 35 in the database root
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 20-SEP-2017 15:02:57.15
```

Example: No Full Backup After TSN Reset

```
$! Re-set TSNS
$ rmu/repair/initialize=tsns device:[directory]mf_personnel.rdb
%RMU-I-AIJ_ENABLED, This database has after image journaling enabled...
 You should create a new journal after this operation completes.
%RMU-I-FULBACREQ, A full backup of this database should be performed after
RMU REPAIR
$!
$! Try to apply original .aij; should not succeed
$!
$ rmu/recover/log/root=device:[directory]mf_personnel.rdb
device:[directory]pers_aij.aij
%RMU-I-LOGRECDB, recovering database file DISK:[DIRECTORY]MF_PERSONNEL.RDB;2
%RMU-F-TSNNOSYNC, The transactions in this journal file are not consistent
with the transactions in this database root file
-RMU-F-CANTSYNCTSNS, Last committed TSN 448 in the after image journal file
exceeds last committed TSN 0 in the database root
%RMU-F-FTL_RCV, Fatal error for RECOVER operation at 20-SEP-2017 16:08:16.96
```

New Support for DEFAULT Index NODE SIZE Calculation

- Prior to Oracle Rdb V7.3.1, the default node size was computed as 430 or 860 for longer keys
- Afterwards, maximum node size that could be stored on a page was used as the default
- Some environments would prefer the default NODE SIZE for a sorted index to be smaller than that currently computed by the Rdb.
  - Due to activity (DELETE and UPDATE of key values)
  - Concurrency where the application wants fewer keys to be locked
  - When the page size is very large (e.g. 32 or 63 blocks)

New Support for DEFAULT Index NODE SIZE Calculation

- New RDMS$DEFAULT_INDEX_NODE_SIZE_SMALL logical can be defined to enable an smaller node
  - Similar in size to that of prior versions
- RDMS$SET_FLAGS logical name or SET FLAGS statement can specify 'INDEX_SIZING(SMALL)' to select this algorithm.
- The setting 'INDEX_SIZING(LARGE)' or 'NOINDEX_SIZING' will revert to the other algorithm

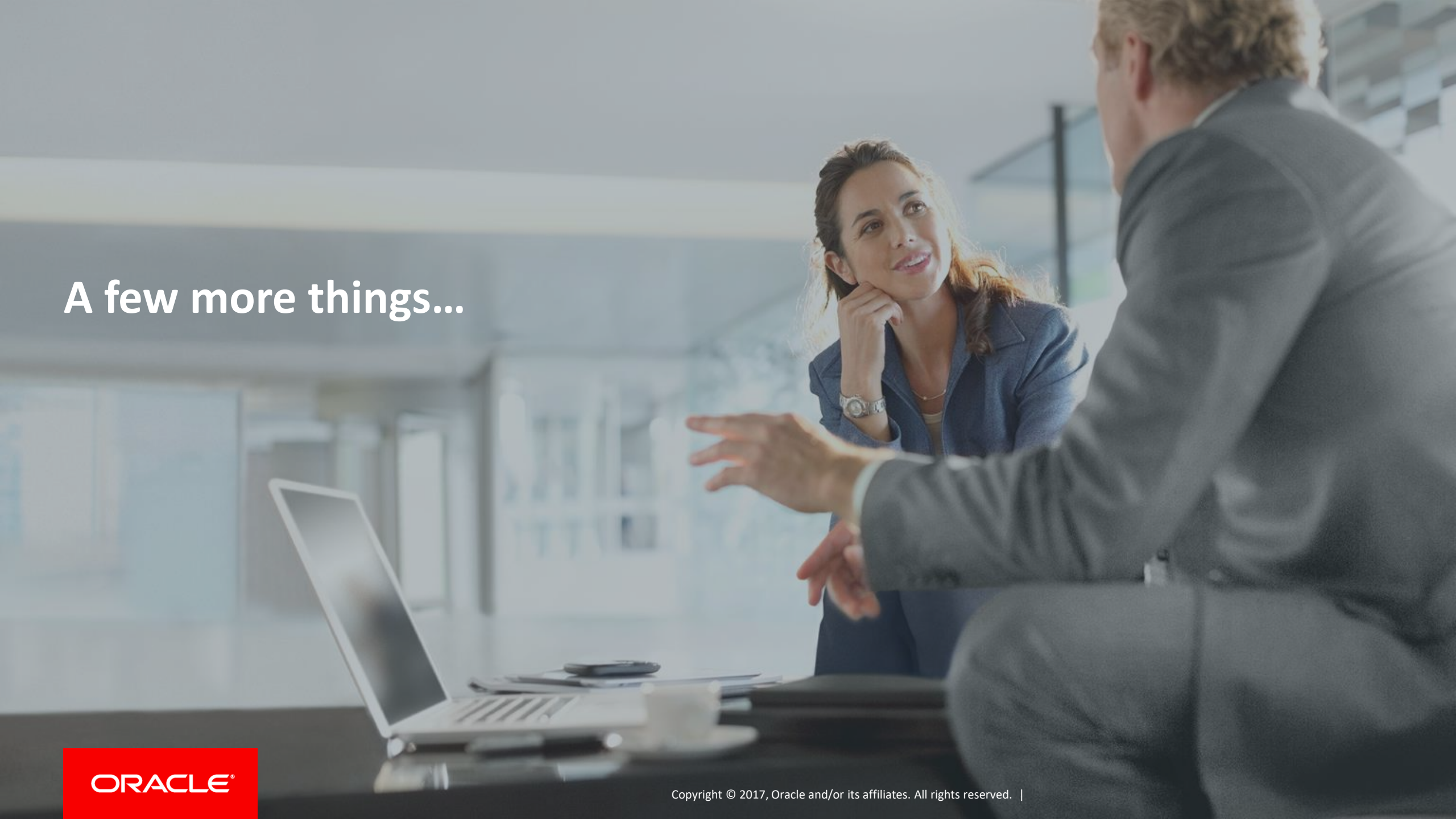
New RMU Dump Symbols Command

- Displays or writes to a specified output file the contents of database root file information.
  - Output is similar to that from RMU Dump Header except that the output is in the form of a DCL command procedure that defines global DCL symbols
  - Meant for database administrators who wish to write DCL procedures that react to the current state of the Rdb database

Example: RMU Dump Symbol CLIENT_FULL_BACKUP_TIMESTAMP

```
$ v = 'f$verify(0)
$ set noon
$!
$! Check the last full backup date and see if backup is past due
$!
$ temp_file = "temp" + f$getjpi(0,"PID") + ".tmp;"
$ RMU/DUMP/SYMBOL/EXECUTE/PREFIX=PERS_/OUTPUT=&TEMP_FILE SQL$DATABASE
$ delta_time = f$delta_time (PERS_CLIENT_FULL_BACKUP_TIMESTAMP,"TODAY")
$ days = f$integer(f$element(0," ",delta_time))
$ if days .gt. 7
$ then
$       alert_text = f$fao("Database PERS not backed up in !SL day!%S", days)
$       write sys$output alert_text
$       ! reply/username=DBADMIN "''alert_text'"
$ endif
$ delete &temp_file
$ exit ! 'f$verify(v)'
```

A few more things…



New logical name: RDMS$BIND_DEADLOCK_WAIT

- Allows sub-second deadlock wait
  - Note: SYSGEN DEADLOCK_WAIT has minimum value of 1 second
- Interface to SYS$SET_PROCESS_PROPERTIESW system service
  - The smallest value is 100000 (which is 10 milliseconds)
  - The largest value is 10000000 (which is 1 second)
- Out of range values are quietly ignored (will use SYSGEN DEADLOCK_WAIT)
- Applied at first Rdb ATTACH (CONNECT, etc) only
- Refer to OpenVMS documentation

TCP/IP Proxy Access

- Now support PROXY access when transport is TCP/IP
- Must have V7.3.2 (or later) on both client and server systems
- Designed to allow easy change from DECnet proxy to TCPIP
- Uses OpenVMS services to access existing proxy database

TCP/IP and Rdb Proxy

- Rdb uses existing proxy database on the remote system
- Uses OpenVMS System services to match incoming credentials with granted proxy access
  - No longer need USER and USING syntax, nor
  - SQL_USERNAME or SQL_PASSWORD (in configuration file)
- Use OpenVMS utility AUTHORIZE to view and create proxy entries

TCP/IP Proxy

- Enabled by default
- Can disable default proxy access using this variable SQL_ENABLE_TCPIP_PROXY
  - Can disable on client and/or server
- Should use this variable in the configuration file SQL_NETWORK_TRANSPORT_TYPE TCPIP
  - By default Rdb attempts DECnet access first
  - Can improve performance of attach

Questions?

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