Oracle Rdb Status Update

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Oracle's Rdb Strategy

- 21 Years of Rdb
- 11 Years with Oracle
- We're on VMS

- High-end OLTP systems focus
  - High Performance
  - High Availability
- Integration with Oracle software environment
  - Application Server (Java, JDBC)
  - Oracle Enterprise Manager
  - Oracle Media Management API

Rdb: Model for Oracle Software Acquisitions

"….We know how to do this. Ask any customer from our Rdb database acquisition from Digital Equipment Corporation. Nearly nine years later, we are still providing world-class support to thousands of Rdb customers running mission-critical applications."

Larry Ellison, Oracle CEO
quote in advertisements in Business Week,
The Economist, Wall Street Journal + Others

“Ten Years Later” White Paper

Ten Years Later: Thousands of Satisfied Oracle Rdb Customers

No forced migrations—Oracle delivers post-acquisition support, innovation, stewardship

When Oracle acquired Rdb from Digital Equipment Corporation in 1994, we promised to focus on quality and stability while enhancing features based on customer demand. With the acquisition, we purchased patented technology, skilled engineers, and access to an important customer base. Ten years later, we're keeping our promise to thousands of customers worldwide through technical innovation and unwavering support for their mission critical Rdb systems.

Committed to the Future of Rdb

Rdb is over 20 years old, yet in just ten years Oracle has developed more than 50 percent of the code base. Our significant enhancements, dedication, support, and resources continue to make Rdb the best choice for high-throughput database applications on OpenVMS systems—everything from cellular phone billing systems and lotteries to major financial exchanges—and satisfied customers like Intracorp prove it.

"I've worked with Rdb for more than 16 years. Oracle has maintained the outstanding level of customer support for Rdb that existed before its acquisition, and has continued to develop new features and performance enhancements," says Ken McGinnis, database administrator for Intracorp, a Philadelphia-based medical management company with more than 20,000 customers.

When Digital sold the Rdb set of database products, the move concerned many Rdb customers. They wanted assurance that their mission-critical resource would be dependable into the next millennium. Thanks to Oracle, Rdb customers have unequivocally received that assurance.

After acquiring Rdb, we formed independent Rdb Customer Advisory Councils in four regions—North America, Europe, Japan, and Australia/New Zealand—and then listened closely to what the councils had to say, building innovative features to meet customer demand. Ten years later, these same customers praise our successful management of Rdb's acquisition and transition, demonstrating our clear grasp of the different customers and markets for Oracle and Rdb.

While the original contract with Rdb called for three years of development and seven years of support, we've gone well beyond that agreement, with ten years—and counting—of Rdb development and support. With the acquisition, some 90 percent of Digital Rdb employees chose to stay on with Oracle. In fact, Oracle's head of technology development, Executive Vice President Charles A. Rozwat, is a former Digital Rdb executive who joined during the acquisition. Most of the development team, which remains in Nashua, New Hampshire, continues to fulfill commitments made to the Rdb customers, including the development of innovative, high-quality features as prioritized by customers and the councils; broadening the Rdb application set; and integrating Rdb with Oracle's long-term strategies.

ORACLE

http://www.oracle.com/peoplesoft/rdb_casestudy.pdf

Customers Respond

"We began to use Rdb in 1991 and were concerned about continued support when Oracle acquired Rdb. We need not have worried. The support has been very good and very professional and we have always received an immediate response to our inquiries. At no time did Oracle raise the question of migration to their database. The service provided has always been of the highest professional standard."

Agustin Ramos
Systems Technology Manager
Bolsa de Madrid

"When Oracle acquired the product in 1994 we were very worried about Rdb's future. Our worry was misplaced. Oracle instituted processes to help ensure customers were well informed about the future of Rdb. At the same time, Oracle gave Rdb a new lease on life by significantly increasing the resources devoted to enhancing the database. At no point have we felt pressured to move to Oracle's main database product."

Chris Barratt
Development Manager
Flinders Medical Centre

How Rdb Is Used

- Trading commodities, equities & futures: US, UK, Australia, Austria, Sweden, Spain, France, Greece, Italy, Switzerland, Hong Kong, Singapore, Korea, Germany
- Mobile phone: US, Japan, Hong Kong, UK, South Africa, Peru, Germany, Austria, Czech Republic, Denmark, France, Greece, Portugal & Switzerland
- Semiconductor manufacturing
- Lottery Systems: Europe, Canada, Australia, South America, US
- Automobile manufacturing: Volvo, Nissan, Toyota, Fiat ...
- Short Messaging Service
- Passport control: New Zealand
- Government: Ireland, Department of Social, Community and Family Affairs
- Education: Europe, US, Australia -largest secondary education system in Southern Hemisphere
- Reservation systems: Thrifty & Dollar car rental
- Satellite Television
- Automatic Toll Systems
- Health care

Recent Feature Highlights

- Rdb V7.1.4
  - Support for OpenVMS Alpha through V8.2
  - Multiple Optimizer & SQL improvements
  - Sequential Scan Statistics
  - Allocation & extend size for RMU/BACKUP output
- Rdb 7.2
  - In field test – Production in Q4CY05
  - Support for Integrity Servers!
  - Statistics counters promoted to quadword
  - Global buffer maximum count increased to 1 million
  - Rdb executive statistics
  - Increased maximum database buffer and page sizes, I/O sizes
  - AIP caching in lock value blocks
  - Alpha performance enhancements

Rdb Port to Integrity

Portable Product Family

Been There…

- VAX/VMS
- Alpha/VMS
- Digital OSF/1
- Windows NT/Intel
- Windows NT/Alpha

…Going There

- Rdb family
- DBMS
- CDD
- Oracle Trace
- Replication Option
- SQS/OCIS
- JDBC

Scope

- BLISS
- C
- C++
- MACRO64
- MACRO32
- MESSAGE
- Command Definition Utility
- SQL$PRE
- SQL$MOD
- RDBPRE
- FMS
- DCL
- FORTRAN
- Galileo
- SCAN
- AWK
- CMS
- MMS
- TPU
- LSE
- DTM
- DOCUMENT
- RUNOFF/DSRPLUS
- DECforms

Plenty

- ~2.9 million lines of code in Rdb
  - COSI, KODA, Relational Engine, Dispatch, SQL
- SQS/OCIS ~780,000
- Trace ~440,000
- ROR ~190,000
- JDBC ~75,000
- CDD ~1.2 million

Finding Alpha/VAX Specific Source Code

- Search source modules for
  - “COSI$K_VAX”
  - “COSI$K_ALPHA”
  - “COSI$K_INTERP”

- Nearly always I64 same as Alpha

Alpha Compiler Upgrades

- Newer/better C, C++ & BLISS compilers found latent bugs
  - Uninitialized variables
  - Questionable coding practices
  - Unreachable code
  - Etc.

BLISS Register Aliasing

- Explicit register references in source code
- IPF uses an entirely different convention of naming registers than Alpha
- **`BLISS /ALPHA_REGISTER_MAPPING`**

BLISS64

- Not strictly required for port
- Allow native access to 64bit pointers & data
- Still defaulting REF addresses to 32-bit most of the time
- Portions of Rdb doing native 64-bit P2 space addressing
  - More to come

Threading

- “Home grown” threading/co-routine packages
  - KODA Threads
  - RMU (aka “Lou”) Threads
- Replaced with KP threading

Run-time Code Generation

- Rdb generates architecture-specific executable subroutines at run-time
- Intel/NT porting effort created run-time “rich” interpretation engine

Pre-Compiler Code Generation

- Pre-compilers originally created MACRO32 “bridge” subroutines
  - Most migrated to GEM for Alpha port
- Upgraded to latest GEM on Alpha first

Pre-Compiler Interfaces

- Between pre-compiled code & run-time support
- Most JSB entries & Global register usage “upgraded” to standard call-based entry points for I64
- Alpha interfaces left as-is for compatibility

MACRO

- Alpha-MACRO32 code compiles on I64
- Highly optimized MACRO64 for Alpha
  - Some originally in MACRO32
  - No MACRO64 on IPF
    - Either HLL or go back to MACRO32
- No currently scheduled modules for I64 assembler

DCL Procedures Dealing With Architecture

```
$ ARCH := ‘F$GETSYI(“ARCH_NAME”)
$ VAX_NODE = 0
$ ALPHA_NODE = 0
$ IA64_NODE = 0
$ ‘ARCH’_NODE = 1
```

Internal Use of Floating Point

- Most “internal” usage of FP promoted to IEEE
  - Most now common IEEE on Alpha & I64
- On-disk remains the same

Surprises

- Long-latent bugs
- Data-type
- Stack format knowledge
- Some Alpha kit CDD images “VESTed”
- CDD Interfaces used by the compiler groups at HP

Development Environment

- Tri-architecture Cluster
- Started out with “Cross” Tools
  - Compile & Link on Alpha Targeted for I64
  - Most built before first I64 systems arrived
- Now moved to native builds

One Cluster

- CDD, Trace, ROR, SQS on separate clusters
- Migrate all to main development cluster
- Reduce management requirements
- Reduce I64 hardware requirements

Antique Images

- Several build tools have been lost over time
- Some tools only available on VAX
- VAX executables VESTed to run on Alpha
- VESTed executables AESTed to run on IA64
  - Performance isn't of significant concern

SCAN

- VAX SCAN not on Alpha or I64
  - Programs VESTed for Alpha
- AEST support lacking in time for I64
  - Current baselevels work... but result runs ***slowly***
- Converted...
  - Mostly to TPU
  - Some HLL – Vastly faster than original sometimes

Testing Environments

- ~8000 regression tests
  - DTM
  - Lots of command procedures
  - Multiple clusters
  - ~2,800,000 lines of test source code/procedures
- Rdb Random test system

Moving Rdb Applications to Integrity

Porting Your Application

- Most applications are “Compile & Go”
- Likely visit build procedures
  - Command line switches
  - Alpha/VAX choices
- Larger images, working sets, BYTLM & page file quota

Migrating to Rdb 72

- Several avenues...
  - “All At Once”
  - “Perhaps we’ll pace ourselves”

- RMU /CONVERT <database> [/[NO]COMMIT]
  - Takes several seconds
  - Allows “rollback” to prior database structure level
  - No need to recompile or relink existing application

Migrating to Rdb 72

- Cluster I64 & Alpha simultaneously accessing same database
- Alpha, VAX & IA64 can use transparent remote server access

Floating point

- Remember - FP is just an approximation
  - IEEE differs from VAX floating behaviors
- Database on-disk representations not changed
  - IEEE converted to/from VAX floating at run time

Floating point in Rdb Applications

- Precompilers support IEEE today on Alpha
  - *"If in doubt, test it out"* – *anonymous*
- Make sure that all modules use same /FLOAT
  - SQLPRE / SQLMOD
  - Language compilers
- Make certain to prototype all C functions that pass float/double parameters

And What About…?

Embedded SQL... Works as-is

SQL Module Language... Works as-is

Embedded RDO/Rdb... Works as-is

SQL... Works as-is

RDO... Works as-is

RMU... Works as-is

RDML... Works as-is

Etc.

Look Out For While Porting

- Absolutely - upgrade Alpha compilers today
  - Newer compilers do better job finding latent bugs
  - Use /WARNING & /CHECK when compiler provides
  - Even best compiler can not find all bugs
    - I64 & Alpha compilers will differ
- Source code Alpha or VAX specific
  - **`%IF`** or **`#ifdef`**
- Evaluate command procedures for "**`F$GETSYI`**" and "**`ARCH`**", "**`CPU`**", or "**`HW`**"

Where You Likely Have To Do Some Work…

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

MACRO

- MACRO32 – Usually pretty straight forward
- MACRO64 – Rewrite in HLL
- ASM within C – Rewrite in HLL
- Avoid I64 assembler

Linking

- DBHANDLE PSECT
  - No multiple initializations for overlayed PSECT element
  - Multiple modules compiled to initialize DBHANDLE

```
%ILINK-E-INVOVRINI, incompatible multiple initializations for overlaid section
        section: SCP_DB_HANDLE
        module: MOD1SQL file: MODULE1.OBJ
        module: MOD2SQL file: MODULE2.OBJ
```

  - Change to initialize each handle but once

- External References
  - I64 linker checks for external reference type

```
%ILINK-I-DIFTYPE, symbol TEST_CLD of type OBJECT cannot be referenced as type FUNC
        module: TEST file: $1$DKC600:[IA64]TEST.OBJ
```

  - Requires (minor) source code fix

Translated Alpha Images

- At present, we've done little work with them
- Performance expected to be 10x slower
- Is it really important to you?

Very Preliminary
Rdb Performance Indicators

Rdb's First 200tps on I64

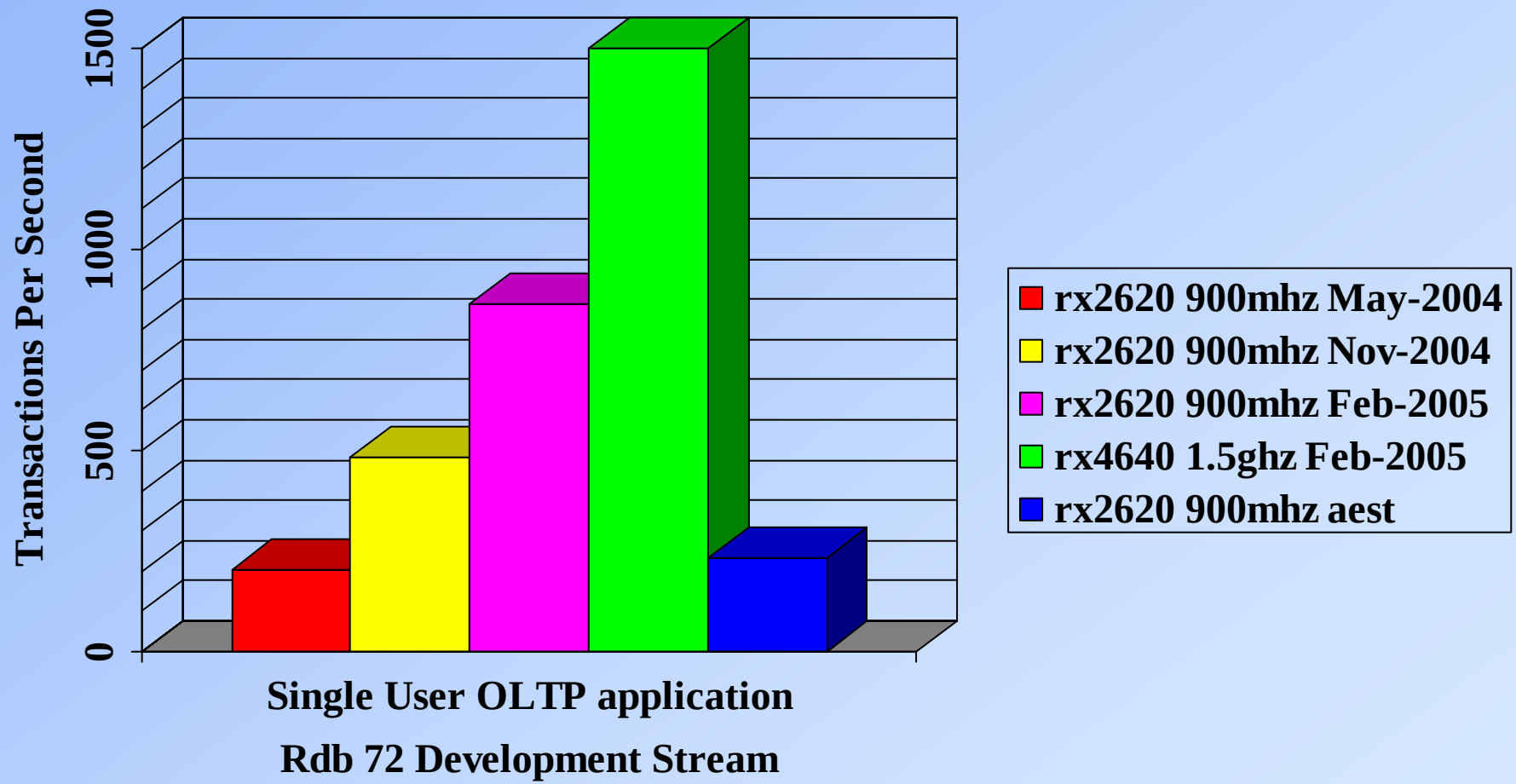
May-2004 - RX2620 900mhz 1.5mb

```
Node: BRDBRY (1/1/1)   Oracle Rdb T7.2-100 Perf. Monitor  5-MAY-2004 19:28:13.55
Rate: 3.00 Seconds          Summary IO Statistics          Elapsed: 00:10:02.75
Page: 1 of 1              DISK$USER:[BIGDB]BIGDB.RDB;3               Mode: Online
```

statistic.....	rate.per.second.....			total.....	average.....
name.....	max.....	cur.....	avg.....	count.....	per.trans....
transactions	436	255	202.7	122235	1.0
verb successes	3496	2044	1622.2	977818	7.9
verb failures	0	0	0.0	0	0.0
synch data reads	0	0	0.0	16	0.0
synch data writes	623	197	166.0	100061	0.8
asynch data reads	0	0	0.0	0	0.0
asynch data writes	35	32	15.7	9498	0.0
RUJ file reads	0	0	0.0	0	0.0
RUJ file writes	1	0	0.5	334	0.0
AIJ file reads	4	0	0.1	118	0.0
AIJ file writes	91	84	61.2	36892	0.3
root file reads	0	0	0.0	0	0.0
root file writes	10	0	0.4	286	0.0

"It's fast… Blindingly fast" – *Jeff Jalbert*

Progress


Transactions Per Second
0
500
1000
1500
Single User OLTP application
Rdb 72 Development Stream
rx2620 900mhz May-2004
rx2620 900mhz Nov-2004
rx2620 900mhz Feb-2005
rx4640 1.5ghz Feb-2005
rx2620 900mhz aest

Alpha – 1729 TPS Apr-2005 – ES45 EV68 1.25ghz

```
Node: VMSMO (1/1/1)  Oracle Rdb T7.2-040 Perf. Monitor  25-APR-2005 14:20:23.81
Rate: 3.00 Seconds        Summary IO Statistics          Elapsed: 00:09:49.62
Page: 1 of 1         DISK$RDB:[BIGDB.ALPHA]BIGDB.RDB;1            Mode: Online
```

statistic.....	rate.per.second.....			total.....	average.....
name.....	max.....	cur.....	avg.....	count.....	per.trans....
transactions	13100	1696	1729.0	957210	1.0
verb successes	104466	13469	13737.6	7605180	7.9
verb failures	0	0	0.0	0	0.0
synch data reads	13133	1697	1731.0	958321	1.0
synch data writes	125	0	6.5	3625	0.0
asynch data reads	0	0	0.0	0	0.0
asynch data writes	12800	1711	1725.3	955153	0.9
RUJ file reads	0	0	0.0	0	0.0
RUJ file writes	0	0	0.0	45	0.0
AIJ file reads	0	0	0.0	0	0.0
AIJ file writes	1600	153	162.1	89792	0.0
root file reads	0	0	0.0	0	0.0
root file writes	12	1	2.0	1169	0.0

30 Database Processes, EVA-based

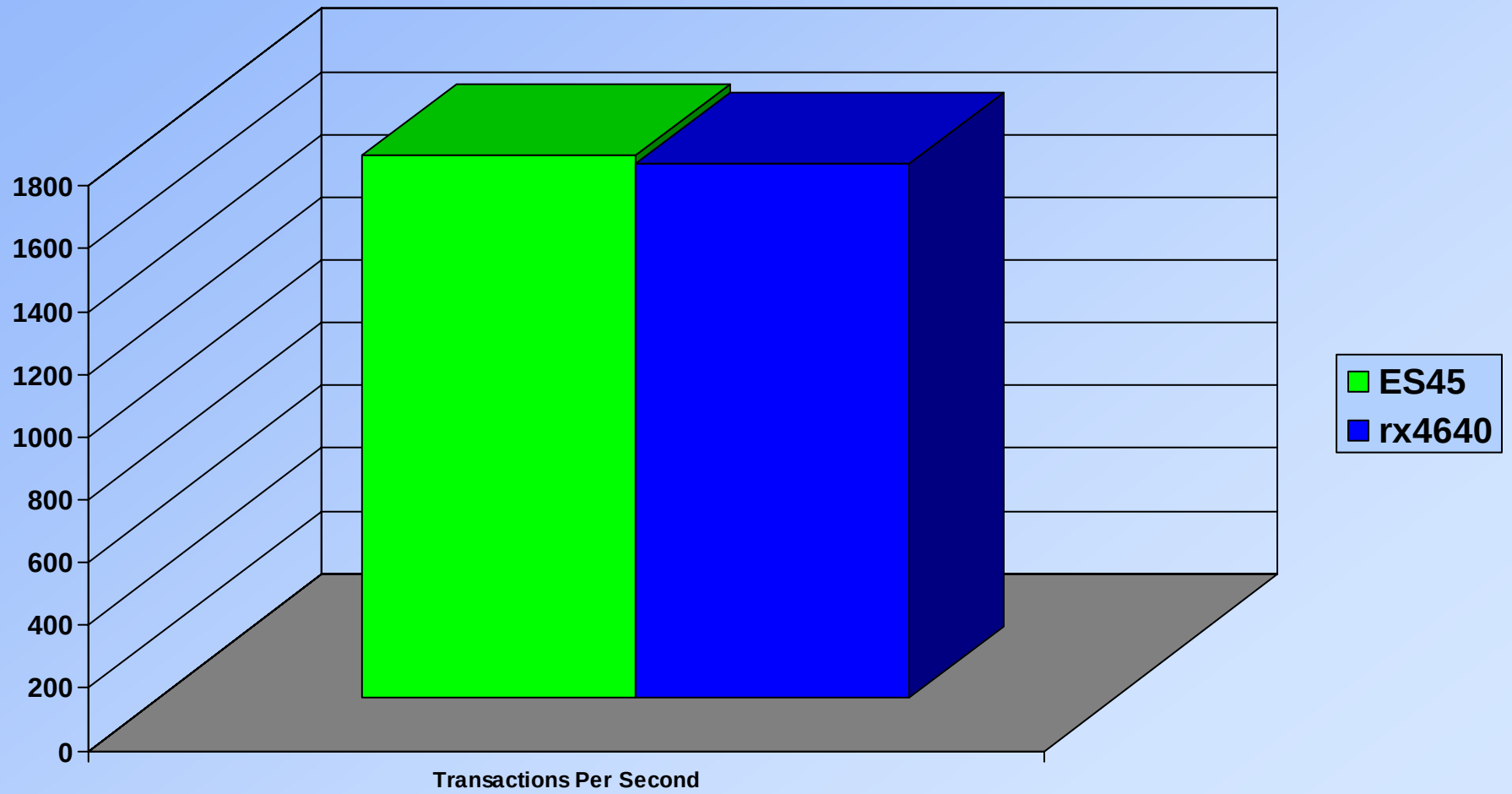
Integrity – 1701 TPS Apr-2005 – rx4640 1.5ghz

```
Node: MTDIB6 (1/1/1)  Oracle Rdb T7.2-040 Perf. Monitor 25-APR-2005 14:33:40.99
Rate: 3.00 Seconds      Summary IO Statistics              Elapsed: 00:09:42.26
Page: 1 of 1         DISK$RDB:[BIGDB.IA64]BIGDB.RDB;1               Mode: Online
```

statistic.....	rate.per.second.....			total.....	average.....
name.....	max.....	cur.....	avg.....	count.....	per.trans....
transactions	2288	1925	1701.1	961990	1.0
verb successes	18144	15383	13531.7	7652359	7.9
verb failures	0	0	0.0	0	0.0
synch data reads	2288	1929	1701.6	962272	1.0
synch data writes	100	0	6.4	3635	0.0
asynch data reads	0	0	0.0	0	0.0
asynch data writes	2286	1931	1695.6	958915	0.9
RUJ file reads	0	0	0.0	0	0.0
RUJ file writes	0	0	0.0	55	0.0
AIJ file reads	0	0	0.0	0	0.0
AIJ file writes	332	275	250.6	141753	0.1
root file reads	0	0	0.0	0	0.0
root file writes	10	1	2.0	1173	0.0

30 Database Processes, EVA-based

Performance Comparison Apr-2005 – RX4640 1.5ghz vs. ES45/1.25ghz



30 process OLTP workload

Tomorrow…

- GS1280 yard stick
  - 32p peak @ 30,000tps

- Between here & there? For both HP & Oracle - plenty of:
  1. Test
  2. Analyze
  3. Correct
  4. Repeat…

Status

Milestones…

Code executes native	February 2003
RDO> prompt seen	May 2003
Monitor code executing	June 2003
Cross Precompiler running	September 2003
Remote database attach	November 2003
Customer application run	December 2003
Multiple database attach	January 2004
IVP Ported & executed	April 2004
Advanced Developers Kit	June 2004
General Field Test	January 2005
Production	Q4CY05

Rdb I64 Development Status

- Daily Rdb/DBMS builds

- VMS updates as available
- Compiler & GEM updates as available
- Frequent Rdb, DBMS, CDD updates to HP

- *"It seems to behave, but who knows when I'm not looking" – Matt Doremus 11/18/2004*

Field Test

Rdb 7.2 Product Family: Alpha & I64 Road Map

- General beta-test began January 2005
  - www.oracle.com/rdb follow “Beta” links
- Production release Q4CY05

Stream	Q1CY05	Q2CY05	Q3CY05	Q4CY05	Q1CY06	Q2CY06	Q3CY06	Q4CY06
Rdb 7.2	**Beta 1**		**Beta 2**	**V7.2** Production Release	Maintenance Release	Maintenance Release	Maintenance Release	Maintenance Release

Again – The Messages

- Expect...
  - “Compile & link - test if you must”
  - To spend most effort in build procedures
  - Larger image files
  - To need larger working set, bytlm & pgflquota
  - Everything to be just fine

For More Information

- **http://h71000.www7.hp.com/openvms/integrity/BA442-90001.PDF**
  "Porting Applications from HP OpenVMS Alpha to HP OpenVMS Industry Standard 64 for Integrity Servers"

- **www.oracle.com/rdb** - follow "Beta" links

Credit Due

- The following people were kind enough to share their experience & assistance to help made this presentation possible:
  - Guy Peleg
  - Christian Moser
  - Greg Jordan
  - Jeff Jalbert
  - Tom Musson
  - Paul Benoit
  - Ian Smith
  - Paul Mead
  - Craig Showers

http://www.oracle.com/rdb

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