

The background of the slide is a photograph of the Oracle New England Development Center. It features several modern, cylindrical glass buildings with blue-tinted windows, situated along a body of water. Lush green trees and a rocky shoreline are in the foreground. The sky is clear and blue.

Rdb V7.2

Itanium Port

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Agenda

Rdb Port to Itanium

Porting Your Applications

Status & Direction

Alpha Getting Tyred?





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
- ROR



Languages, Compilers, Tools used to build/develop Rdb

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



Finding Alpha/VAX Specific Source Code

- Search source code for "COSI\$K_VAX" & "COSI\$K_ALPHA"
 - Nearly always I64 same as Alpha
- Procedures dealing with architecture

```
$ ARCH := 'F$GETSYI("ARCH_NAME")  
$ VAX_NODE = 0  
$ ALPHA_NODE = 0  
$ IA64_NODE = 0  
$ 'ARCH'_NODE = 1
```



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
- Used for I64



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



Alpha Compiler Upgrades

- Newer/better compilers found latent bugs
 - Uninitialized variables
 - Questionable coding practices
 - Unreachable code
 - Etc.



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



Internal Use of Floating Point

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



CDD Porting Surprises

- Some images were originally “VESTed”
 - Original code never converted to native on Alpha
 - Time to face the music
- Interfaces used by the compiler groups at HP



Development Environment

- “Cross” Tools
 - Compile & Link on Alpha Targeted for I64
 - Most built before first IPF systems arrived
- Tri-architecture Cluster
- Someday to move to 100% native builds



SCAN

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



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



Compilers & Tools are there

- Compilers...
 - COBOL
 - Fortran
 - Pascal
 - BASIC
 - C
 - C++
 - BLISS
 - Ada FT
- iMACRO32
- SET COMMAND
- MESSAGE
- Etc. etc. etc.
- DECSET (CMS, MMS, LSE, DTM, PCA, etc.)
- MSAI/AEST
- AWK/GREP/etc.
- FMS
- DECnet/TCPIP
- ACMS FT
- Shadowing/RAID
- Etc. etc. etc.



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
- Clustering I64 & Alpha using Rdb 72 simultaneously accessing same database
- Alpha, VAX and IA64 can use transparent remote server access



Floating point in Rdb Applications

- FP is an approximation
 - IEEE differs from VAX floating behaviors
- Database on-disk representations not changed
 - IEEE converted to/from VAX floating at run time
- Make sure that *all* modules use same /FLOAT...
 - SQL\$PRE / SQL\$MOD as well as language compilers
- SQL precompilers support IEEE today on Alpha
 - *"If in doubt, test it out"* – anonymous



Data Consideration

- Data alignment
 - More is [much] better
 - Don't be afraid to 'spend' memory
 - Don't bother to change database record layouts
- Floating point binary format or performance
 - Not common problem area in commercial applications



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
 - Remember that even the best compiler can not find all of your latent 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...

- Inner (ie, non-user) modes
- Linking /SYSEXE
- Knowledge of call stack formats, exception frames, PTE, PFN, PC, FP, AP
- Strict floating point behavior requirements
- MACRO
 - MACRO64 - Consider moving to HLL
 - MACRO32 when porting directly from VAX
 - ASM within C
 - Avoid IPF assembler – use HLL



Linking

- DBHANDLE PSECT

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

%**ILINK-E-INVVRINI**, 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

- IPF 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

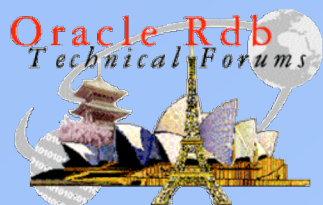


Translated Alpha Images

- At present, we've done little work with them
- Performance expected to be 10:1 slower
- Is it really important to you?



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
VMSINSTAL/IVP ported	April 2004
Advanced Developers Kit	June 2004
General Field Test	January 2005
Production	H2CY05



Rdb IPF Development Status

- Running VMS V8.2 Alpha & I64
 - VMS updates as available
 - Compiler & GEM updates as available
 - Frequent Rdb, DBMS, CDD updates to HP
- Daily Rdb/DBMS builds
- Regression tests running
- Related product builds/tests progressing nicely



CDD

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



...Interlude...

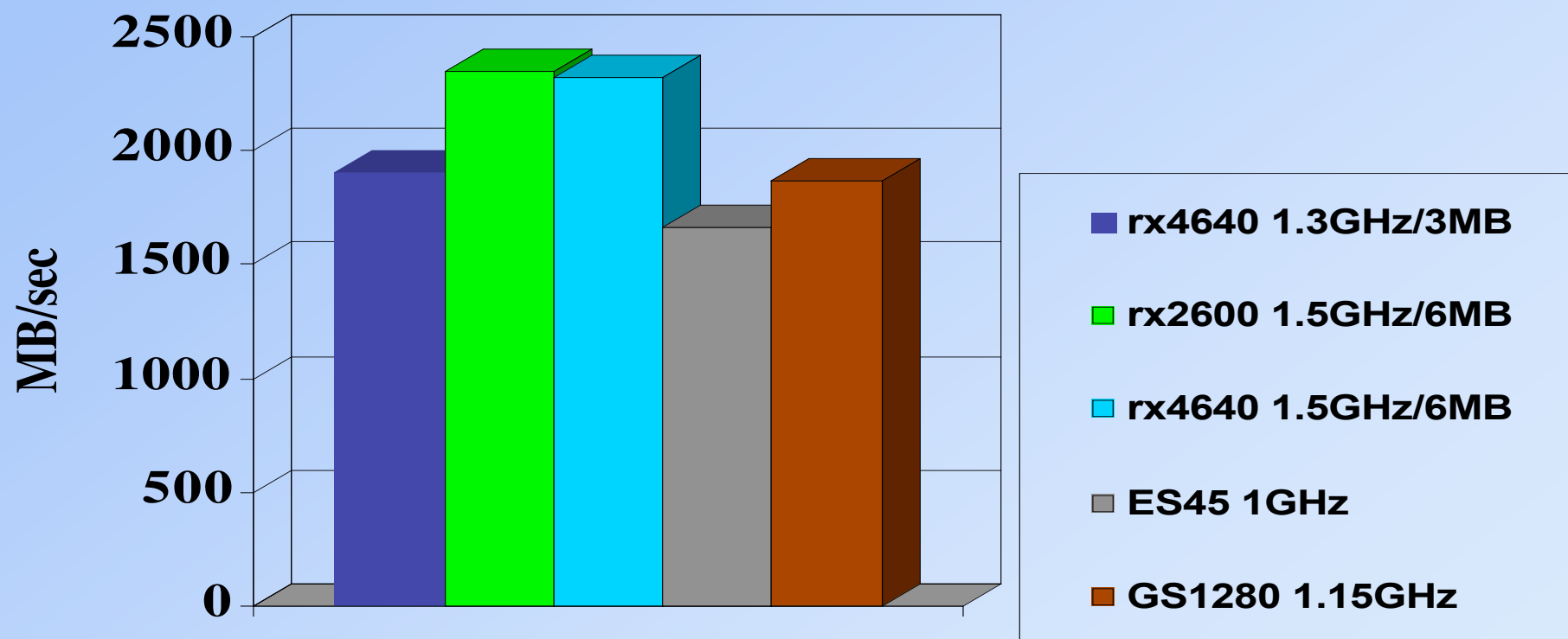
Integrity vs Alpha Performance

(slides borrowed from Christian Moser)



Memory Bandwidth

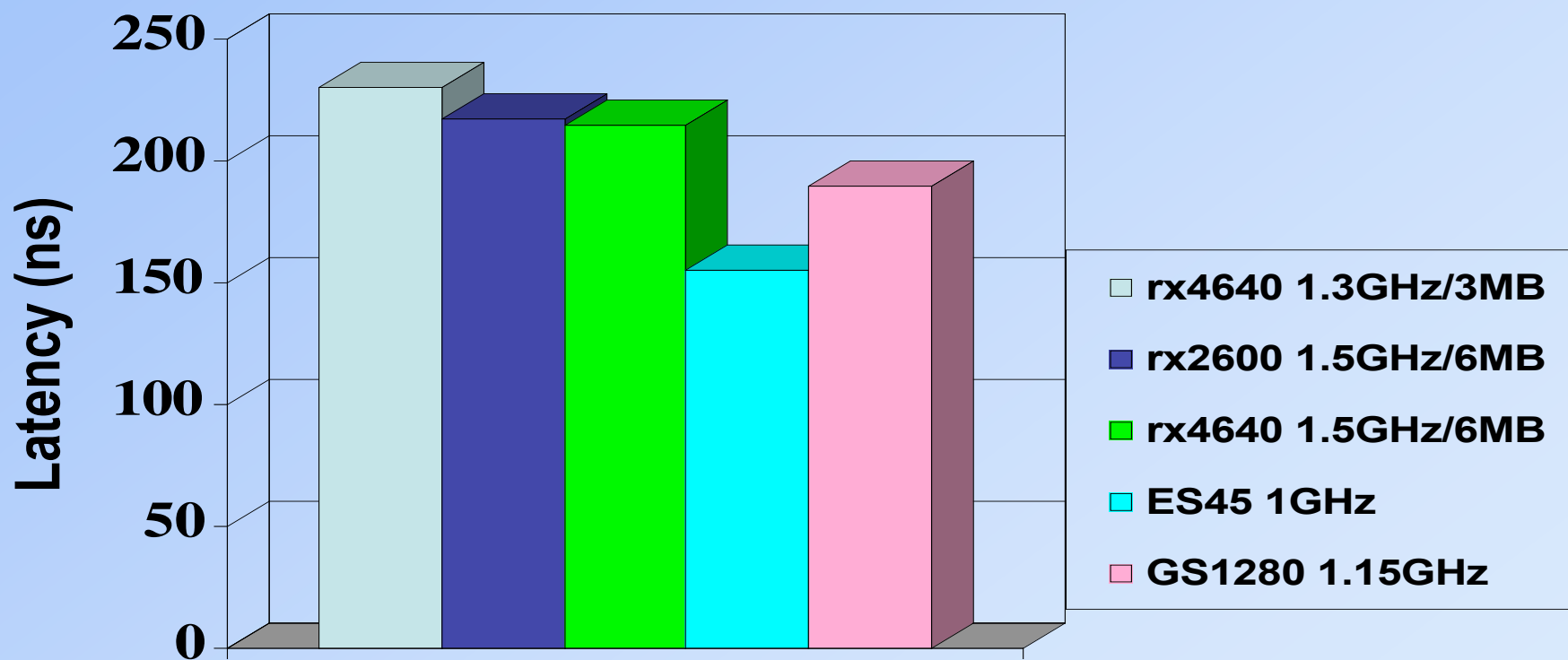
MEMSpeed – Test Program



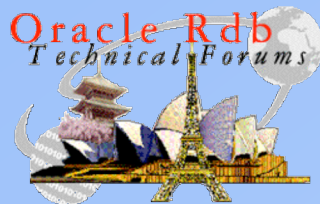
More is better



Memory Latency

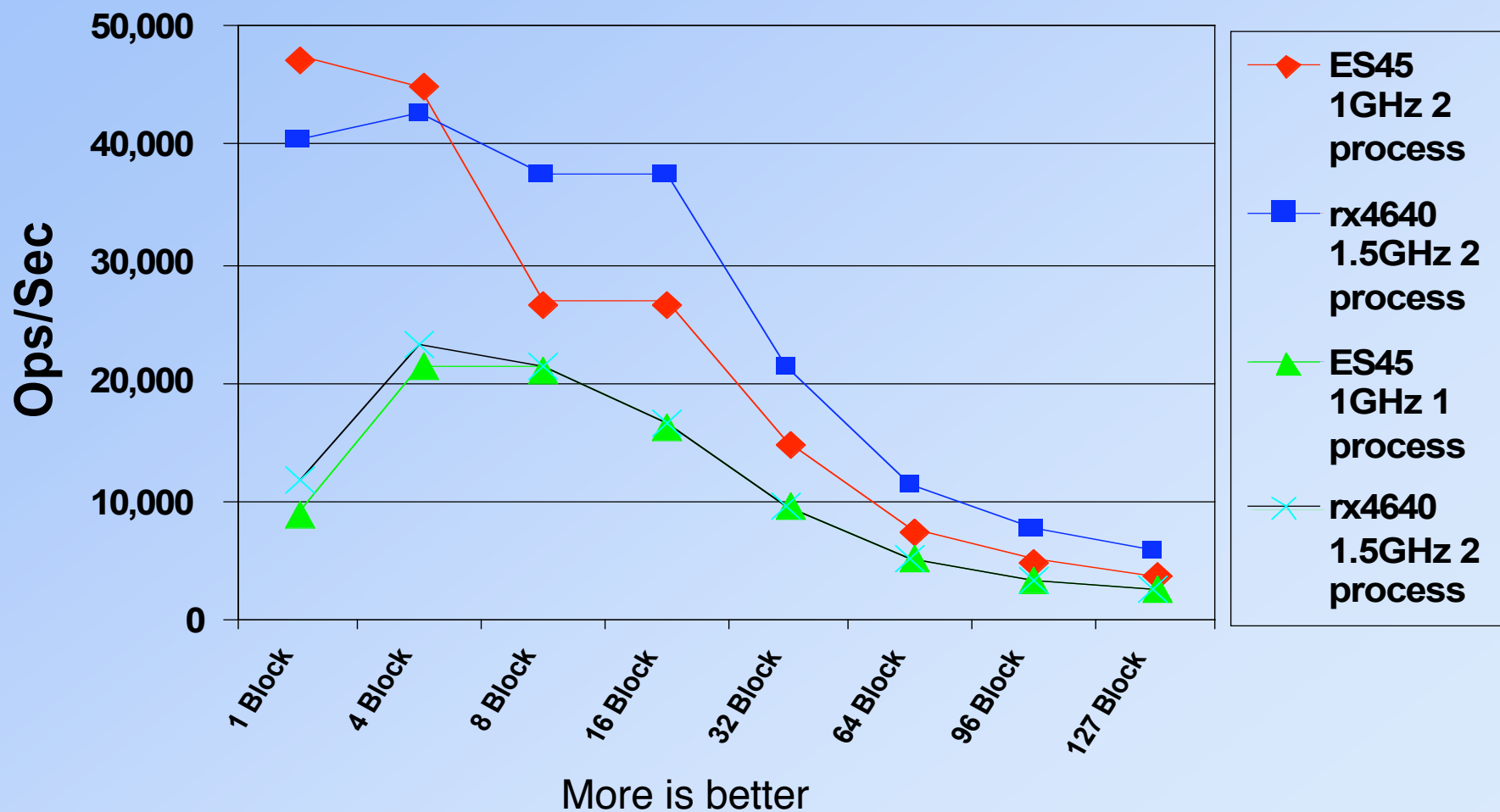


Less is better



IO Performance

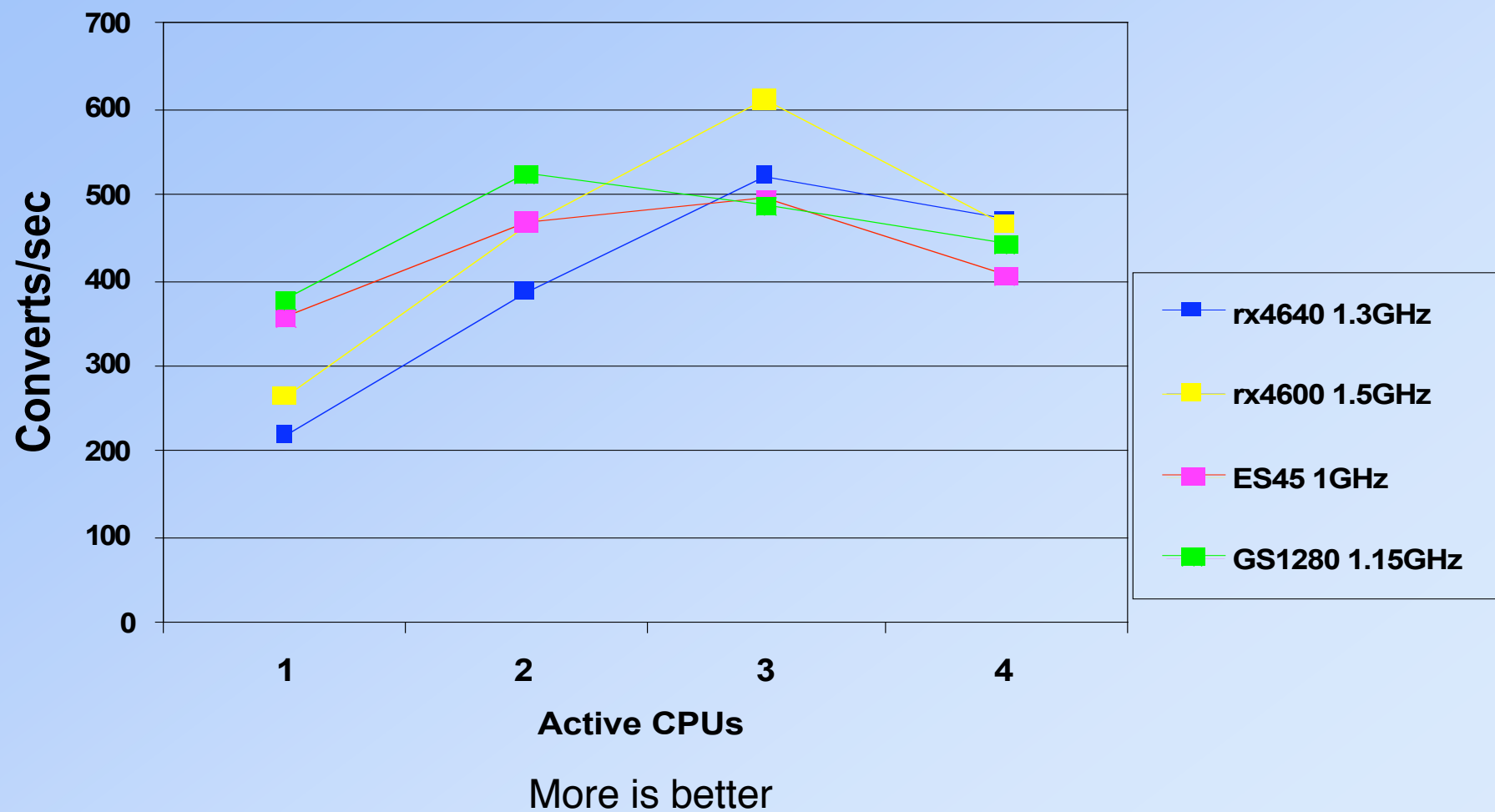
(QLogic ISP23xx) 2Gigabit Fiber Channel Card





Lock Manager Stress Test

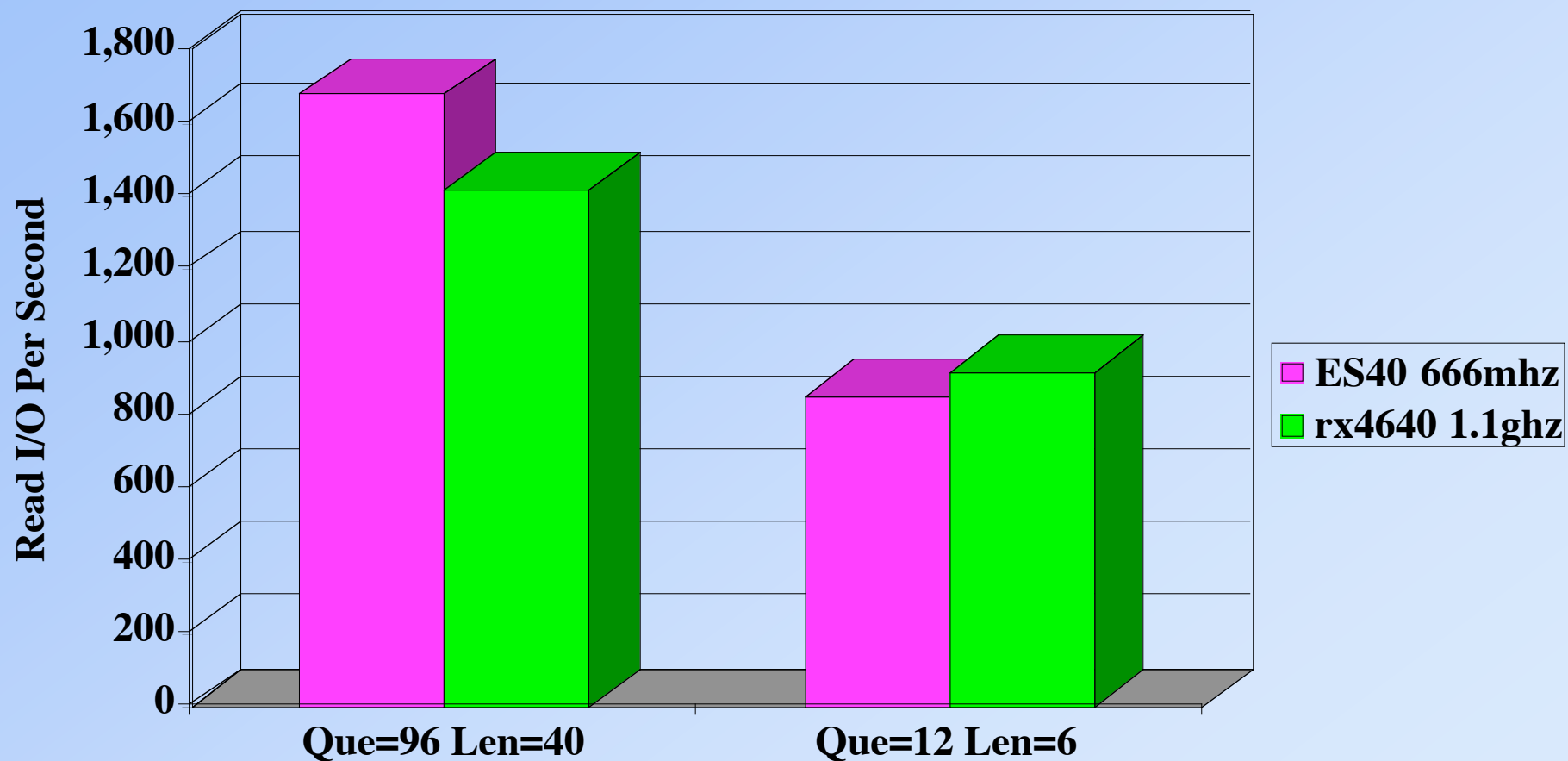
4 Processes





Another IO Performance Test

1 Process, MSA1000-based



(Testing thanks to Jeff Jalbert)



Very Preliminary Rdb Performance Indicators



Rdb's First 200tps on IPF

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



860tps Single User

Feb-2005 — RX2620 900mhz 1.5mb

Node: GIBSON (1/1/1) Oracle Rdb X7.2-00 Perf. Monitor 13-FEB-2005 12:29:40.73
 Rate: 3.00 Seconds Summary IO Statistics Elapsed: 00:02:10.76
 Page: 1 of 1 DISK\$DBMS_REGTEST:[BIGDB]BIGDB.RDB;1 Mode: Online

statistic.....	rate.per.second.....			total.....	average.....
name.....	max.....	cur.....	avg.....	count.....	per.trans....
transactions	940	832	866.2	113277	1.0
verb successes	7526	6663	6931.1	906312	8.0
verb failures	0	0	0.0	0	0.0
synch data reads	867	772	798.0	104354	0.9
synch data writes	138	0	7.0	921	0.0
asynch data reads	0	0	0.0	0	0.0
asynch data writes	1108	974	1011.0	132209	1.1
RUI file reads	0	0	0.0	0	0.0
RUI file writes	0	0	0.0	10	0.0
AIJ file reads	0	0	0.0	0	0.0
AIJ file writes	940	832	866.3	113278	1.0
root file reads	0	0	0.0	0	0.0
root file writes	999	884	920.4	120357	1.0



235 tps Single User Translated Image

```

Node: GIBSON (1/1/1)      Oracle Rdb X7.2-00 Perf. Monitor 14-FEB-2005 10:00:43.09
Rate: 3.00 Seconds        Summary IO Statistics                      Elapsed: 00:02:32.89
Page: 1 of 1              DISK$DBMS_REGTEST:[BIGDB]BIGDB.RDB;1          Mode: Online
-----

```

statistic..... name.....	rate.per.second.....			total.....	average.....
	max.....	cur.....	avg.....	count.....	per.trans....
transactions	246	233	234.7	35891	1.0
verb successes	1972	1869	1878.2	287167	8.0
verb failures	0	0	0.0	0	0.0
synch data reads	229	213	216.5	33104	0.9
synch data writes	0	0	0.2	39	0.0
asynch data reads	0	0	0.0	0	0.0
asynch data writes	301	268	276.1	42216	1.1
RUI file reads	0	0	0.0	0	0.0
RUI file writes	0	0	0.0	2	0.0
AIJ file reads	0	0	0.0	0	0.0
AIJ file writes	246	233	234.7	35891	1.0
root file reads	0	0	0.0	0	0.0
root file writes	262	248	249.4	38135	1.0



1500tps Single User

Feb-2005 — RX4640 1.5Ghz 6mb

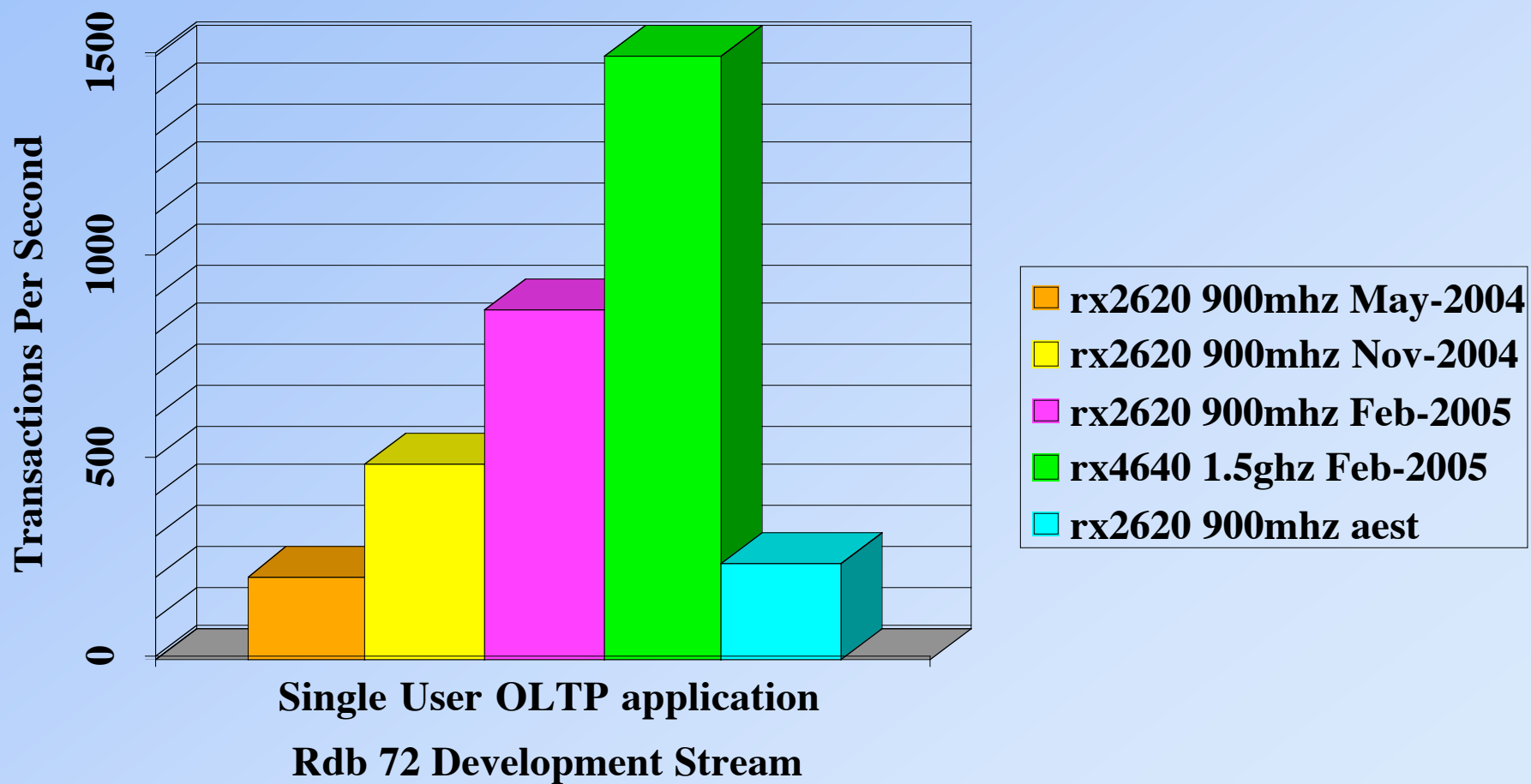
```
Node: WELLS (1/1/1)      Oracle Rdb T7.2-010 Perf. Monitor 14-FEB-2005 10:16:28.07
Rate: 3.00 Seconds      Summary IO Statistics      Elapsed: 00:00:58.15
Page: 1 of 1            DISK$RDBTEST_SYS0:[BIGDB]BIGDB.RDB;1      Mode: Online
```

```
-----
```

statistic.....	rate.per.second.....			total.....	average.....
name.....	max.....	cur.....	avg.....	count.....	per.trans....
transactions	1561	1505	1092.5	63530	1.0
verb successes	12492	12046	8740.1	508241	8.0
verb failures	0	0	0.0	0	0.0
synch data reads	1438	1386	1004.9	58439	0.9
synch data writes	0	0	0.0	1	0.0
asynch data reads	0	0	0.0	0	0.0
asynch data writes	1845	1768	1284.3	74685	1.1
RUI file reads	0	0	0.0	0	0.0
RUI file writes	0	0	0.0	0	0.0
AIJ file reads	0	0	0.0	0	0.0
AIJ file writes	1560	1506	1092.5	63530	1.0
root file reads	0	0	0.0	0	0.0
root file writes	1657	1600	1160.7	67500	1.0



Progress





Alpha – 1729 TPS

Apr-2005 – ES45 EV68 1.25ghz

30 Database Processes, EVA-based

```
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



Integrity – 1701 TPS

Apr-2005 – rx4640 1.5ghz

30 Database Processes, EVA-based

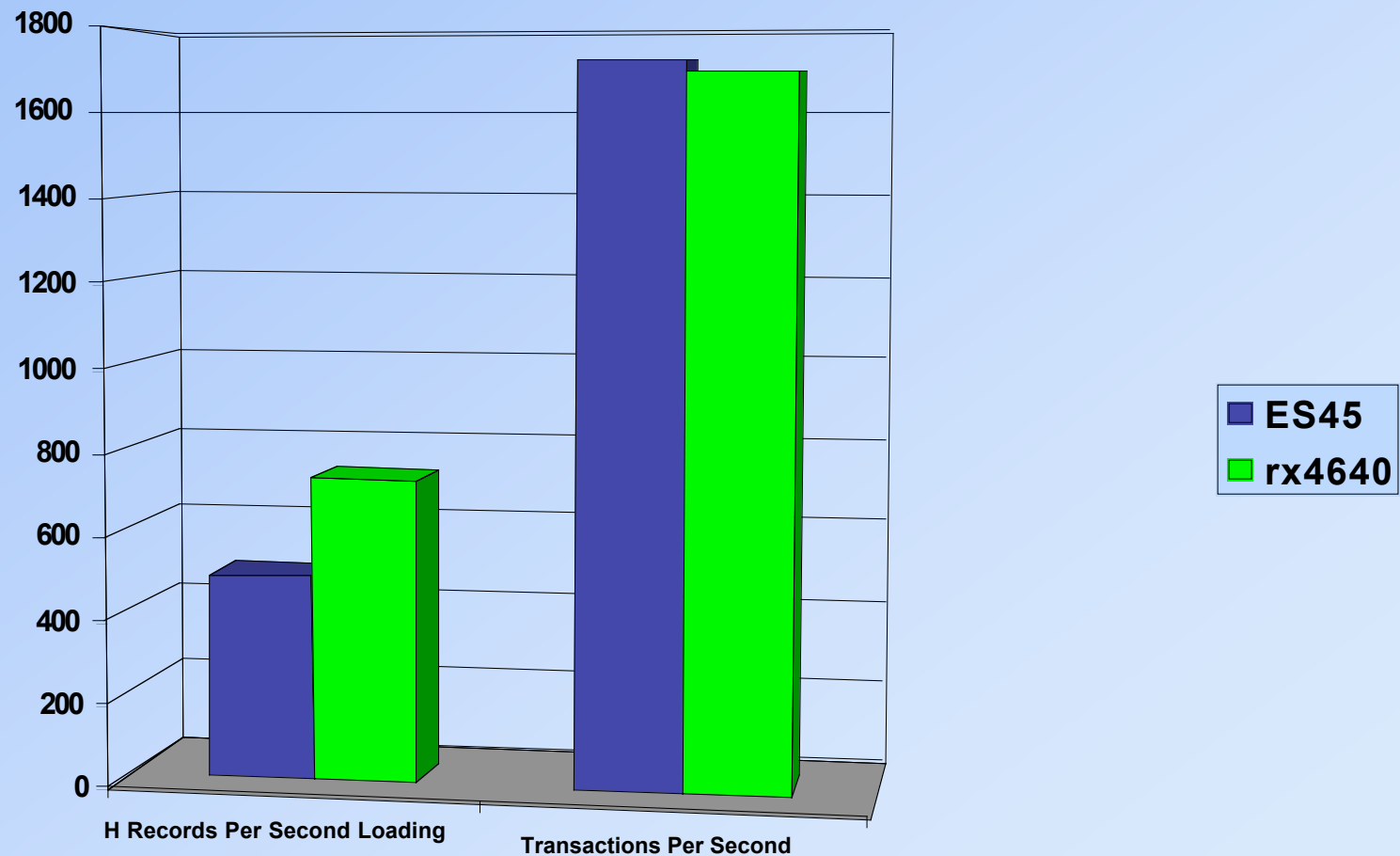
```

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
  
```



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...



Field Test



Rdb 7.2 Field Test

- General beta-test began January 2005
- Electronic FT signup on web
 - www.oracle.com/rdb follow "Beta" links



Rdb's 7.2 Field Test And You

- Not production...
 - Performance
 - Reliability
 - Functionality
- Minimum requirements
 - OpenVMS IA64 V8.2-1
 - V8.2 prior to FT2
 - OpenVMS Alpha V8.2
 - V7.3-2 prior to FT2



Considerations

- Not (yet) completely reliable
 - OCI Services for Rdb (aka SQL*net)
 - SQL/Services
 - Parallel options (backup & load)
 - Replication Option
 - Oracle Trace
 - Translated image support
- Targeted for FT 2



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, bytlim & pgflquota
 - Everything to be just fine



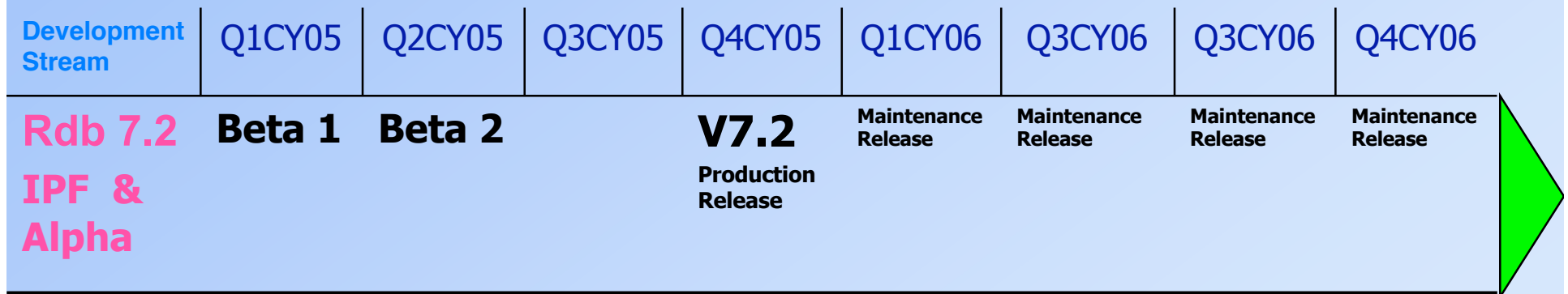
One Final Thought...

Product	Final Order Date	Final Ship Date
Alpha Systems	30-Sep-2006	30-Dec-2006
Alpha CPU Upgrades	30-Sep-2007	30-Dec-2007

*Source: *HP OpenVMS Version 8.2 Release Notes*



Oracle Rdb 7.2 Roadmap





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

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 - Guy Peleg
 - Christian Moser
 - Greg Jordan
 - Jeff Jalbert
 - Tom Musson
 - Paul Benoit
 - Ian Smith
 - Paul Mead
 - Craig Showers



Q & A

QUESTIONS
ANSWERS

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