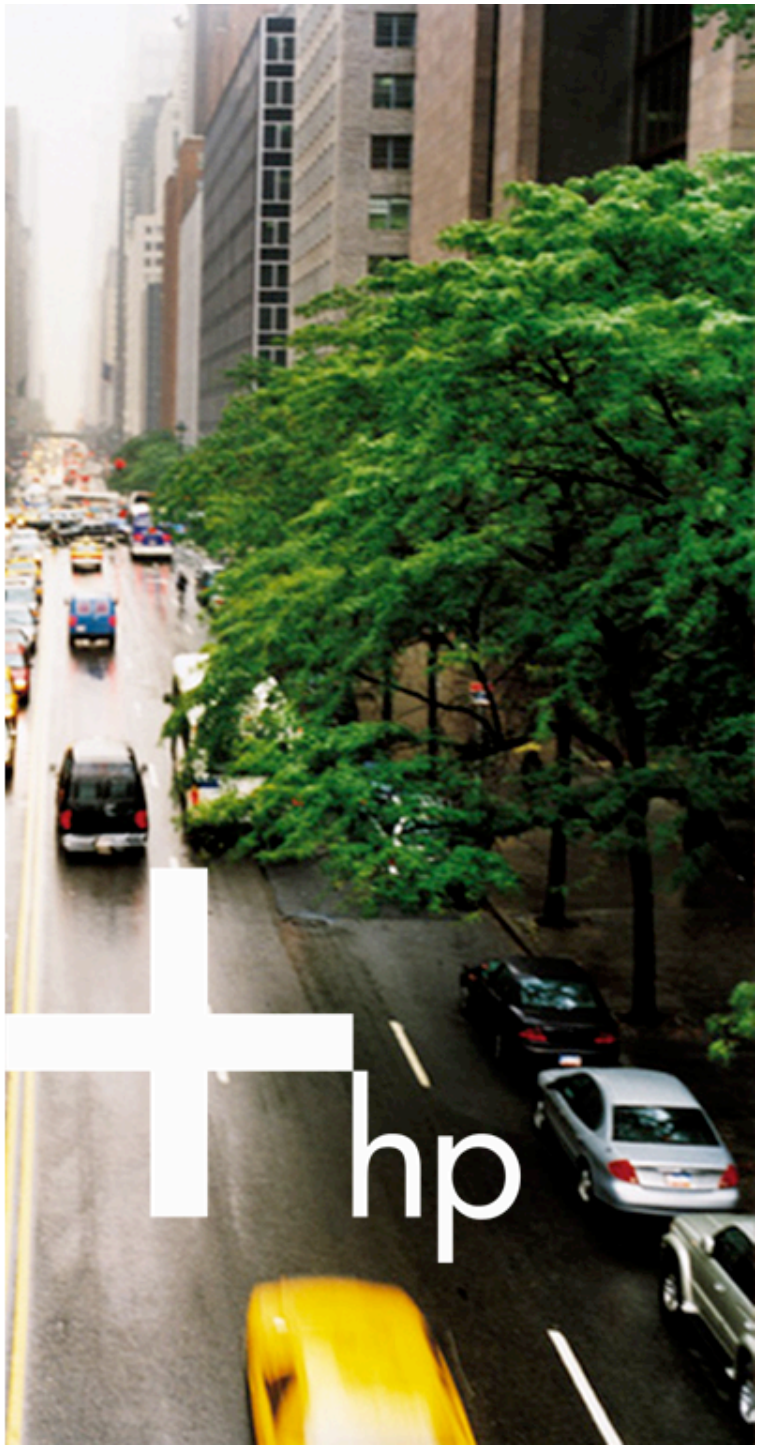
Oracle Rdb Technical Forum

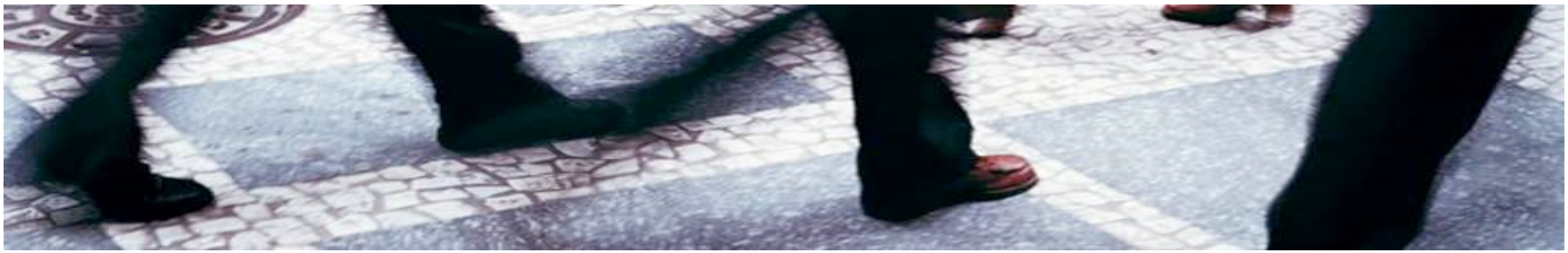
HP OpenVMS Integrity Update



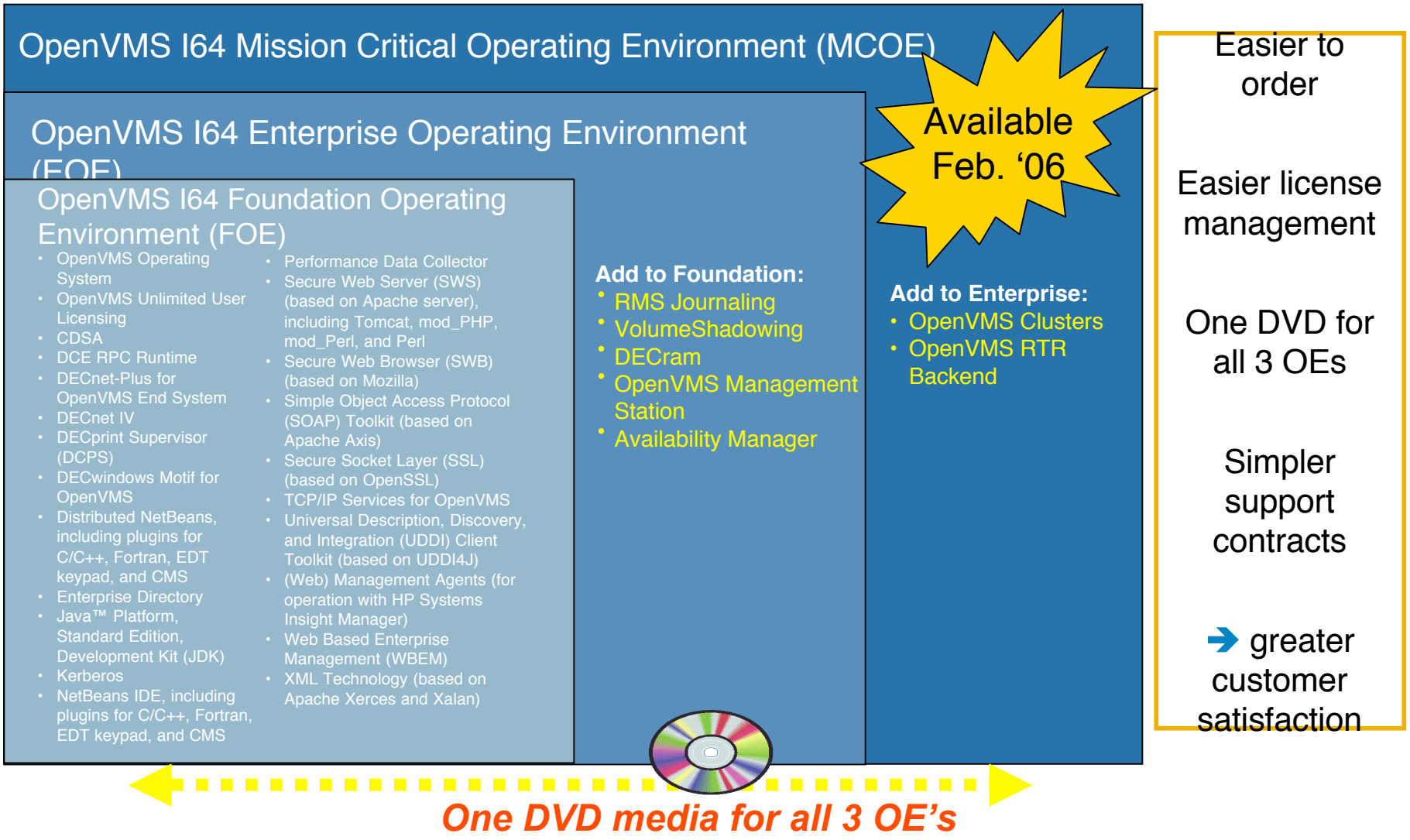
Greg Jordan,
OpenVMS Engineering
Hewlett-Packard Company

Agenda

- Integrity Licensing
- Integrity Rollout and Systems
- Porting to Itanium
- Performance



Operating environments for OpenVMS on HP Integrity servers



Easier to order

Easier license management

One DVD for all 3 OEs

Simpler support contracts

➔ greater customer satisfaction

Subject to change

OpenVMS Integrity Operating Environment Per-processor Core License (PCL) Pricing

Tiered Licenses	List Price US$/Core
Tier 1 : Up to 2 sockets	
Foundation OE	$895
Enterprise OE	$6,160
Mission Critical OE	$10,410
Tier 2 : 2 to 4 sockets	
Foundation OE	$1,195
Enterprise OE	$6,160
Mission Critical OE	$10,410
Tier 3 : Unlimited sockets	
Foundation OE	$2,970
Enterprise OE	$7,940
Mission Critical OE	$12,170

Layered Product Licensing for Integrity Systems

- Compilers are licensed on per-user basis
- All other layered products are licensed on a per-core basis

License Trade-In Rules to Integrity

- License transfer from AlphaServer or VAX
  - Services contract (with license to use)
    - Even swap at no charge for “equivalent product”
    - Parallel usage for a set period
    - Must purchase at least one year of support
  - No services contract
    - 60% discount on new license price
    - Parallel usage for a set period
    - Must purchase at least one year of support

Integrity Rollout and Systems

Integrity Rollout and Systems

- Layered Products
- Alpha Roadmap
- Integrity and Alpha Systems – equivalencies

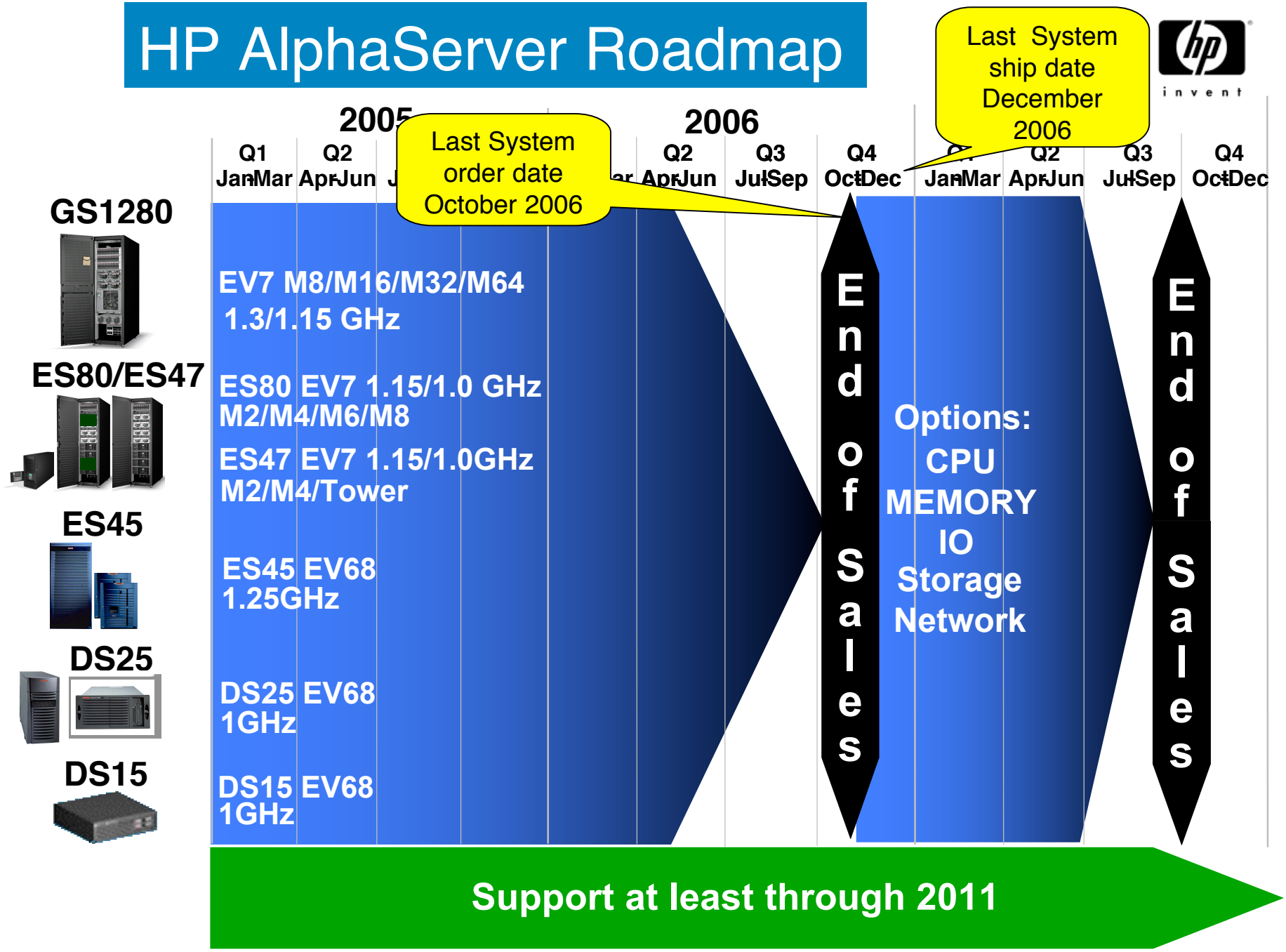
OpenVMS Integrity Layered Product Phase Rollout Plan

<table>
<tr><th colspan="2">Available Now!</th><th>H1 2006</th></tr>
<tr>
<td>
• Compilers:
  • BASIC
  • C
  • C++
  • COBOL
  • Fortran
  • Pascal
• DECset tools
• DCE
• DQS
• FMS
• OpenView OVO Agent
• RAID Software
• Archive Backup System
• Data Cartridge Server
• Disk File Optimizer
• Hierarchical Storage Manager
• Media Robot Utility
• Reliable Transaction Router
• Save Set Manager
• X.25
• HP OpenVMS Migration Software
</td>
<td>
•BaseStar Family
•BASEstar Open Server
•Omni API
•Omni MMS
•DECoasp/H1
•DECosap/ AP
•Siemens S7

•ACMS (including TP Web & TP Desktop Connectors)
•DECforms

•CIFS (Samba) evaluation kit
</td>
<td>
•BEA MessageQ
•Datatrieve
•DEC/EDI
•Global Workload Manager (gWLM)
•GKS (Q3)
•IBM Interconnect Family (Q3)
•TDMS (Q2)
</td>
</tr>
<tr><th colspan="2"></th><th>Not Porting</th></tr>
<tr><td colspan="2"></td><td>•Advanced Server
•Storage Library System (SLS)</td></tr>
</table>

HP AlphaServer Roadmap



Subject to change without notice

AlphaServer / Integrity server comparison

High End

Integrity $363,878
rx8620
- 8P, 6MB Cache 1.6 GHz
- 32 GB memory
- Unlimited users

Alpha $916,145
GS1280 Model 8
- 8P
- 32 GB memory
- Unlimited users

Mid Range

Integrity $56,276
rx4640 4P Server
- 4P, 6MB Cache 1.6 GHz
- 16 GB memory
- Unlimited users

Alpha $213, 790
ES47 Model 4
- 4P
- 16 GB memory
- 25 users

Entry Class

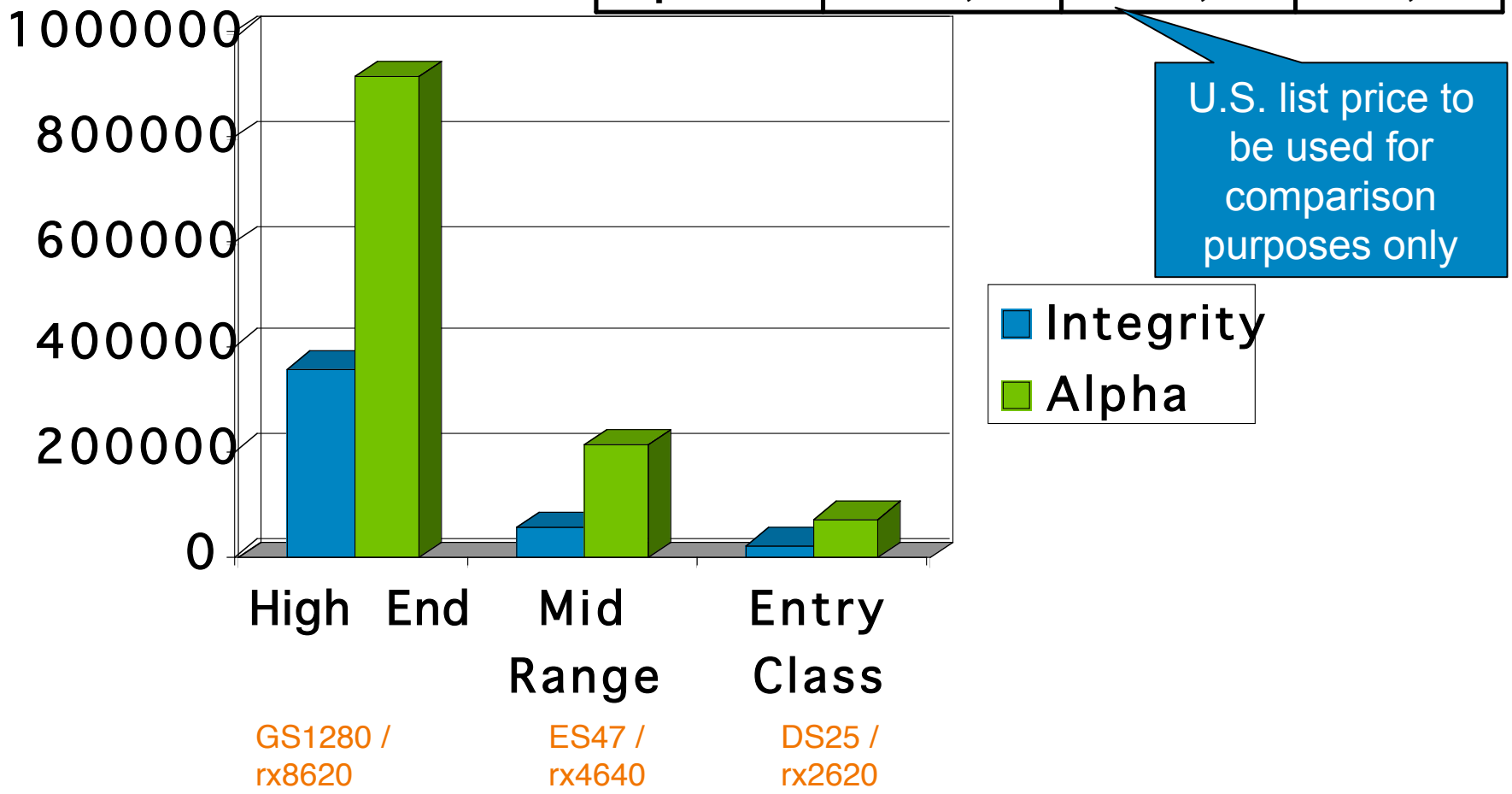
Integrity $25,296
rx2620 2P Server
- 2P, 6MB Cache 1.6 GHz
- 8 GB memory
- Unlimited users

Alpha $74,708
DS25
- 2P
- 8 GB memory
- 25 users

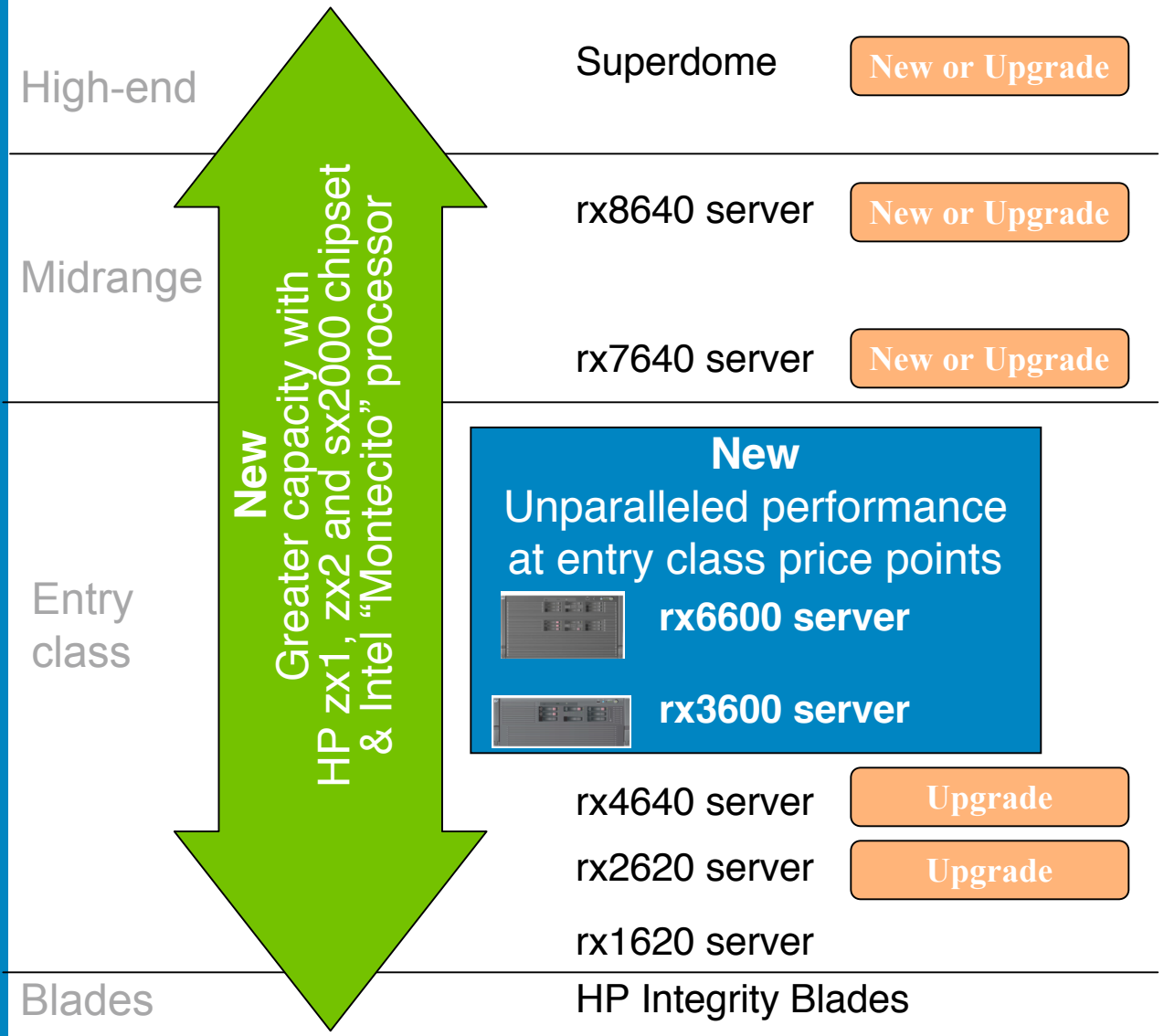
AlphaServer/Integrity server pricing Comparisons

	High End	Mid-range	Low End
Integrity	363,878	56,276	25,292
Alpha	916,145	213,790	74,708

U.S. list price to be used for comparison purposes only



Twice the capacity with Integrity servers and Intel Dual-core Itanium 2 processors



"…HP Integrity rx4640 server with dual-core Intel Itanium 2 processors proved it to be **80 percent faster than our current rx7620 server while consuming only a fraction of the power**. …."

Betandwin

HP Integrity Servers: the Broadest Line of Itanium®-based Systems

invent

128 HP Integrity Superdome

Up to 128-way scalability and hard-partitioning capability for leading consolidation

- Up to 64 Intel® Itanium® 2 processors or HP mx2 dual-processor modules, consisting of two Intel Itanium 2 processors
- Up to 1 TB memory
- 192 PCI-X slots (with I/O expansion)
- Up to 16 hard partitions

32 HP Integrity rx8620-32 server with server expansion unit (SEU)

32-way scalability and hard-partitioning capability for consolidation

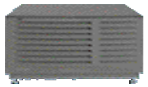
- 2- to 16-way Intel Itanium 2 processors or HP mx2 dual-processor modules
- Up to 128 GB memory
- 32 PCI-X slots (with SEU)
- Up to 4 hard partitions
- 2 servers per 2m rack

16 HP Integrity rx7620-16 server

16-way flexibility with high-performance, density, and hard-partitioning capabilities

- 2- to 8-way Intel Itanium 2 processors or HP mx2 dual-processor modules
- Up to 64 GB memory
- 15 PCI-X slots
- Up to 2 hard partitions
- 4 servers per 2m rack

8 HP Integrity rx4640-8 server



4-way high-performance servers in ultra-dense and highly scalable models

- 1- to 4-way Intel Itanium 2 processors or HP mx2 dual-processor modules
- Up to 64 and 96 GB memory
- 6 and 10 PCI-X slots
- 10 and 5 servers per 2m rack

4 HP Integrity rx5670 server

4-way high-performance servers in ultra-dense and highly scalable models

- 1- to 4-way Intel Itanium 2 processors
- Up to 64 and 96 GB memory
- 6 and 10 PCI-X slots

2 HP Integrity rx2620-2 server and rx1620-2 server

2-way ultra-dense, power-packed server redefines entry-level computing

- 1- to 2-way Intel Itanium 2 (rx2600-2) or Low Voltage Itanium 2 (rx2600-2—1.4 1.0 GHz; rx1600-2—1.0 GHz) processors
- 1U (rx1600-2) & 2U (rx2600-2) form factor
- Up to 24 GB memory
- 4 PCI-X slots
- 20 servers per 2m rack

Windows Server 2003  OpenVMS HP-UX 11i Version 2

OpenVMS on Blades

- All the benefits of Blades technology
  - Lower TCO
  - Common unified management
  - Consistent industry standards
  - Flexibility
  - Dynamic Provisioning
  - Multiple OS's in the same enclosure

PLUS

Blades and OpenVMS Clusters

- Increased availability
  - Clustering
    - Within Blades enclosure
    - Within Datacenter
    - Multiple sites
  - Rolling OS upgrades without taking environment down
- At least 66% of OpenVMS customers buy the size of Server which could be incorporated into a Blades infrastructure[1]

Notes: [1] Based on sales figures over the last 10 quarters

Porting to Itanium

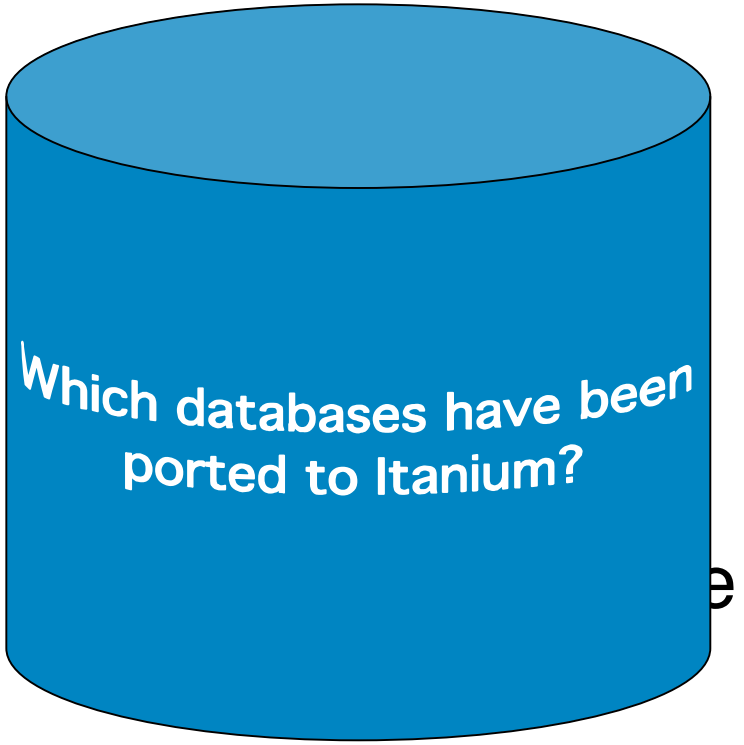
Our OS Porting Goals

- Provide an operating system environment, development tools, and documentation to make porting as easy as possible
  - Full port of the Operating System, Runtime Libraries, development tools and most layered products
  - Recompile, relink, requalify
- Use our experiences porting the operating system to make it easier for others to port their applications
  - Internal layered product groups, partners, and customers

We Succeeded

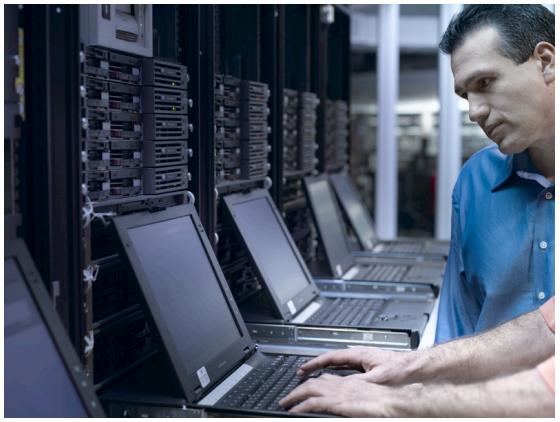
- Customer experience:
  - Porting applications to I64 is easy
  - Re - compile
  - Re - link
  - Test

Integrity Server databases available today on OpenVMS



OpenVMS Customer Lab

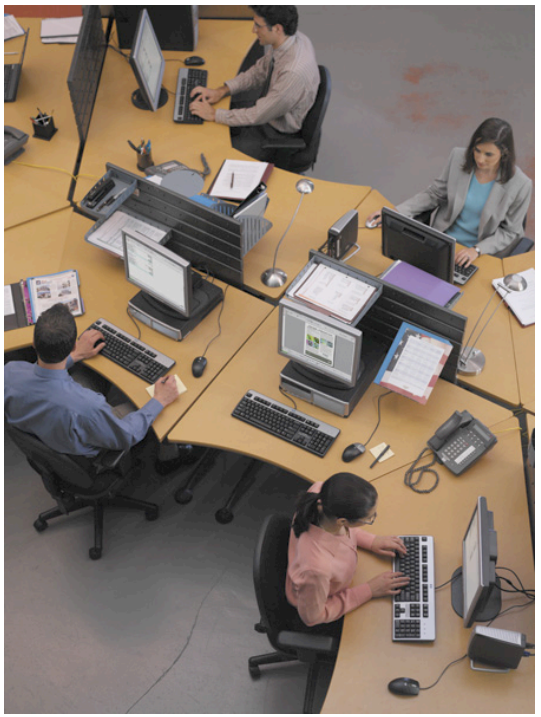
- The perfect place to establish the proof points you need to size your OpenVMS solutions on Integrity
- Customer Lab Activities:
  - Porting assistance
  - Application testing
  - Configuration/technical management
  - Performance testing
  - Access to OpenVMS Engineers at Nashua, NH site



Contact Name: John.Egolf@hp.com

Providing assistance with OpenVMS HP Integrity server transition

- Joint Intel/HP Developer's Forums
  - Events held in North America this year
  - Tampa, Washington DC, San Diego, Houston/Dallas, Seattle, Boston
  - Languages: C, C++, Fortran, COBOL, BASIC, Pascal, Macro32, Java, Bliss, DCL, Dibol
  - Some solutions ported from VAX directly to Integrity
- Multi- day workshops - to evaluate the current environment and plan for transition and integration
- Consulting Expertise Center - jointly staffed with HP and Intel experts
- Worldwide Porting Centers - for validating ISV and custom applications on Integrity servers
- Comprehensive portfolio of white papers with "how to" transitioning information



Porting to OpenVMS I64

- Major changes in the O/S
  - Different primitives provided by “hardware”
  - Different default floating point standard
  - New compilers
  - New image format
  - New calling standard
  - No console/PAL code

Most changes are transparent but some might affect your application

Conditionalized code

- Include file with symbol definitions for conditionalizing code in SYS$SHARE:ARCH_DEFS.H, .MAR, .REQ
- C / C++

```
#ifdef ALPHA                    #ifdef IA64
#endif                  #endif
```

- Macro32

```
.if df ALPHA            .if df IA64
.endc                   .endc
```

- Bliss32 / Bliss64

```
%if ALPHA %then     %if IA64 %then
%fi                 %fi
```

Build Environment

- Update your build procedures
- DCL
  - Lexical function f$getsyi(”arch_name”)
  - Define symbols VAX, ALPHA and IA64
  - $ if .not. ALPHA
  - $ if IA64
  - ...

General Development/Porting Rules

- Object file and image file sizes are larger on OpenVMS I64 than on OpenVMS Alpha
- Alignment faults are more costly on I64 than on Alpha
- Applications should be built on OpenVMS Alpha using the latest versions of the compilers before they're ported to OpenVMS I64
- Consult each compiler's Release Notes for problems and restrictions with the current version of the compilers

Alpha Compilers

- HP recommends that you build your applications on OpenVMS Alpha using the latest versions of the compilers prior to starting your port to OpenVMS I64
- Latest/Next Releases on Alpha Platform
  - C V7.1, C++ V7.1
  - Fortran V8.1 (F90)
  - Basic V1.6
  - COBOL V2.8
  - Java 1.4.2-3
  - Pascal V6.0

OpenVMS on Integrity Server Compilers

- C
  - Itanium® architecture implementation of OpenVMS HP C V7.2 compiler
- C++
  - Based on the same front end compiler technology as HP C++
  - This is not a port of HP C++ V7.1 but it will be able to compile most of the same source code as HP C++ V7.1
- COBOL, BASIC, PASCAL, BLISS
  - Itanium architecture implementations of the current OpenVMS compilers
- ADA
  - AdaCore is shipping the IA64 version any day or has shipped by now

IMACRO

- On I64 the calling standard changed
  - We now use Intel's software conventions
  - IA64 only preserves register R4-R7 across routine calls (Alpha preserves R2-R15)
  - For programs written in high-level languages (like C,Bliss) this difference is not visible.
  - When MACRO-32 programs added you have to start worrying about how to pass register parameters between languages.
  - High-level languages might trash a register IMACRO assumed to be preserved (and vice versa)
  - Please reference the IMACRO porting guide for more details

C++ Default Model

- The default value for the /MODEL qualifier is ARM on Alpha and ANSI on IA64
- /MODEL is ignored on IA64
  - ANSI is the only supported format
  - May require changes to existing code
    - See the C++ release notes for full details:

      http://h71000.www7.hp.com/commercial/cplus/I64_doc/rni64.html

- Compiled with /MODEL=ARM string literals are of type “array of char”
- Compiled with /MODEL=ANSI string literals are of type “array of const char”

C++ V7.2

- Read release notes thoroughly
- Supports 64-bit pointers
  - /POINTER_SIZE=64
- Variadic macros now supported
  - Allows macros to take a variable number of arguments
- Supports new section type in object file
  - Maps mangled names to their original unmangled form

IEEE floating- point

- Itanium supports only IEEE floating-point in hardware
- On IA64 - IEEE floating-point is the default floating point format for the compilers.
  - *VAX floating point formats supported when specified as a switch to the compilers*
  - *The compilers generate code to call conversion routines (performance hit).*

IEEE floating- point

- To use IEEE change the source to use S & T versions of the APIs.
  - Some functions (like sin, cos,….) already know how to handle IEEE and require no changes to the application.
- Instead of using the compiler defaults use the /FLOAT qualifier to make it clear what you want
  - /FLOAT=IEEE_FLOAT
  - /FLOAT=G_FLOAT
- White paper
  - http://h71000.www7.hp.com/openvms/integrity/i64-floating-pt-wp.pdf

IEEE floating- point

- On IA64, the default value for the /FLOAT qualifier is IEEE_FLOAT. LIB$CVTF_TO_INTERNAL_TIME assumes F-float and therefore it fails on IA64.
- Compiled on IA64 with /FLOAT=G_FLOAT forced the compiler to use the default Alpha representation (F for float, G for double.
  - No code changes are required in this case but there is some runtime cost.
- To use IEEE floating point representation, this program should be modified to use LIB$CVTS_TO_INTERNAL_TIME
- LIB$WAIT is another common example where floating point conversion may become an issue… routine had a 3rd parameter to specify which floating format to use

New Calling Standard

- Publicly available as part of VMS online documentation
- Intel® calling standard with OpenVMS modifications
  - No frame pointer (FP)
  - Multiple stacks
  - only 4 preserved registers across calls
  - Register numbers you're familiar with will change
- All OpenVMS provided tools "know" about these changes
- Most user applications are not affected
- Your code that "knows" about the Alpha standard will almost certainly need to change
- http://h71000.www7.hp.com/openvms/integrity/resources.html

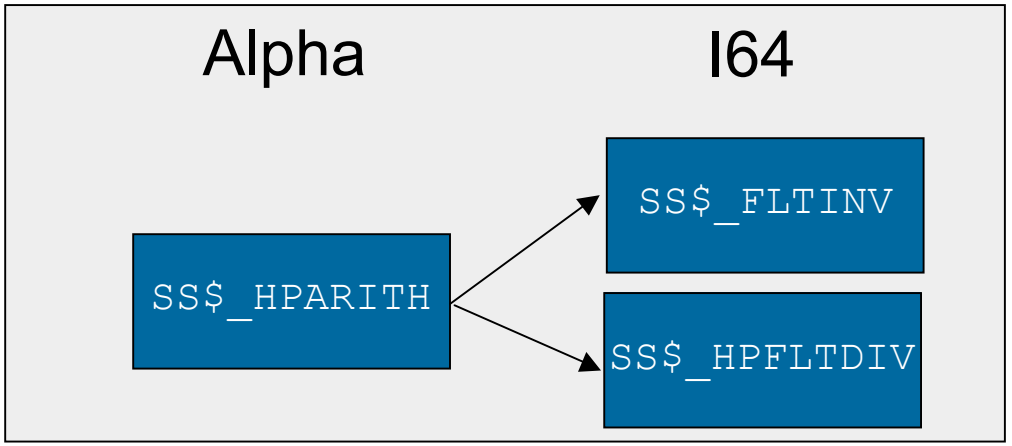
So you REALLY think you understand the stack?

- You wrote your own threading package?
  - Many threads doing work
  - Use for error handling
- Itanium has two stacks
- Itanium has a lot more state
- VERY hard to get right
- Use KP Threads (it's not just for kernel mode anymore)
- Available on Alpha too

Condition Handlers Use of SS$_HPARITH

On OpenVMS Alpha, SS$_HPARITH is signaled for a number of arithmetic error conditions. On OpenVMS I64, SS$_HPARITH is never signaled for arithmetic error conditions; instead, the more specialized SS$_FLTINV and SS$_FLTDIV error codes are signaled on OpenVMS I64.

Update condition handlers to detect these more specialized error codes. In order to keep code common for both architectures, wherever the code refers to SS$_HPARITH, extend it for OpenVMS I64 to also consider SS$_FLTINV and SS$_FLTDIV.



Quotas, Quotas and more Quotas

Quotas and process settings

- OpenVMS I64 images are much larger, sometimes 3x-4x
- Ensure your pgflquo and bytlm are (at least) 4x-10x your Alpha settings.
  - $ set default sys$system
  - $ run authorize
  - UAF> mod your_account/pgflquo=nnnnnn
  - UAF> mod your_account/bytlm=nnnnnn

THREADS

- THREADCP tool was not ported to OpenVMS I64
  - Relink to change threads related characteristics of an image
  - Use the new SET IMAGE command

- If your application increases the stack size for a thread from the default size, you should increase it more

  HP recommends starting with an increase of three 8-Kb pages (24576 bytes).

Major Porting Considerations

- Object file format
  - ELF/DWARF industry standards plus our extensions
    - ELF - Executable and Linkable Format, Itanium® architecture object code, images, etc.
    - DWARF - Debugging and traceback information (embedded in ELF).
  - All OpenVMS provided tools “know” about these changes
  - Most user applications are not affected
  - User written code that “knows” the object file format may have to change
  - Specifications are available on the WEB

Reading EXE and OBJ files

- Use ANALYZE/IMAGE vs. parsing the EXE file.
- We are looking at adding a callable interface into SHOW/SET image.

ANALYZE/IMAGE	DCL Symbol that is set	Sample Value
/SELECT=ARCHITECTURE	ANALYZE$ARCHITECTURE	OpenVMS IA64
/SELECT=NAME	ANALYZE$NAME	"DECC$COMPILER"
/SELECT=IDENTIFICATION=IMAGE	ANALYZE$IDENTIFICATION	"C T7.1-003"
/SELECT=IDENTIFICATION=LINKER	ANALYZE$LINKER_IDENTIFICATION	"Linker I02-08"
/SELECT=LINK_TIME	ANALYZE$LINK_TIME	"6/29/2004 4:26:35 PM"
/SELECT=FILE_TYPE	ANALYZE$FILE_TYPE	Image
/SELECT=IMAGE_TYPE	ANALYZE$IMAGE_TYPE	Executable

Performance: Alignment faults

- Once the port of the application has been completed, you should look at alignment faults
  - Alignment faults are expensive on Alpha but are 100 times more expensive on IA64
    - The DEBUG SET MODULE/ALL command used to take 90 seconds. After fixing some alignment faults, it now takes 2 seconds.
    - DCL procedures takes approx. 10% less time to execute after fixing alignment faults in DCL.
  - Detect at runtime: FLT extension in SDA or using SET BREAK/ALIGN option in the debugger
  - At compile time with compiler switches:
    - $ cc /warn=enable=alignment
    - $ cxx/warn=enable= (MISALGNDSTRCT,MISALGNDMEM)
    - $ f90/warning=align (the default)

Performance: Setjmp/Longjmp

- Significant performance gains by using __FAST_POSIX_SETJMP (V8.3) or __FAST_SETJMP or UNIX_SETJMP
- Differences vs normal setjmp/longjmp
  - Does not call intervening condition handlers
- __FAST_SETJMP and __UNIX_SETJMP have small difference from normal (return value 0 not changed to 1)
- Available on Alpha too

Performance: Fortran compile-time init

- Very large common blocks with fields initialized at compile time may result in excessively large object files and long compile and image activate times
- This problem does not exist on Alpha
- Perform data initialization at runtime or move the initialized data to a smaller common block to avoid the problem
- True of other languages initializing a bit of data in huge psect

Wait a second….I don't have the sources…

- OpenVMS Migration Software for HP AlphaServer Systems to HP Integrity Servers (OMSAIS)
- Utility that translates executables and shareable images from Alpha to I64
- Supports translation of images written in: C, C++, Fortran, COBOL, BLISS, MACRO-32, MACRO-64

OMSAIS

- OMSAIS includes two components:
  - AEST (Alpha Environment Software Translator)
  - TIE (Translated Image Environment)

- TIE provides run-time support for translated images
  - Integrated into V8.2-1
  - Separate download for V8.2

- Free download available from:

http://h71000.www7.hp.com/openvms/products/omsva/omsais.html

Integrity Adoption

Recent OpenVMS on Integrity wins

The National Cancer Institute (NCI) at Fort Detrick, Maryland will be deploying its first Integrity server running OpenVMS, an eight-processor HP Integrity rx8620 Server

The U. S. Postal Service is deploying 74 Integrity rx2620 Servers running OpenVMS to support thousands of mail sorting machines at processing facilities across the country.

Deutsche Börse Systems (DBS), the full-service IT provider for Germany's stock exchange, is deploying ten HP Integrity rx1620 and ten rx2620 Servers running OpenVMS to provide access points for brokers and banks to its trading systems.

Philips Semiconductors is deploying eight HP Integrity rx2620 servers running OpenVMS at its Nijmegen, Netherlands manufacturing facility.

““…I feel compelled to say that the HP INTEGRITY SERVER has awakened the OpenVMS sleeping giant.”

John Buonaugurio
Knowa Corporation

Knowa ™

"As the world's leading provider of Investment management, brokerage and business process management solutions, DST International is very pleased that HP has made the decision to offer OpenVMS on its entire Integrity Server line. The robustness, security and high-availability of OpenVMS is a preferred choice of our clients. We are proud to work with HP to continue to enable the most effective and trusted software solutions on the market today."

- Rhonda Lepsch"
  CEO, Asia
  DST International

“Our mixed cluster of OpenVMS on HP Integrity servers and AlphaServer systems provides us with the high availability and security required by our faculty, students and staff. By integrating proven technology with the latest advancements in performance and price/performance, we take advantage of a 25-year investment in this operating system, while preparing a smooth transition to the next generation of computing platforms.”

Jean-Pierre Petit
Chairman, Computer Engineering Department
ESME-Sudria

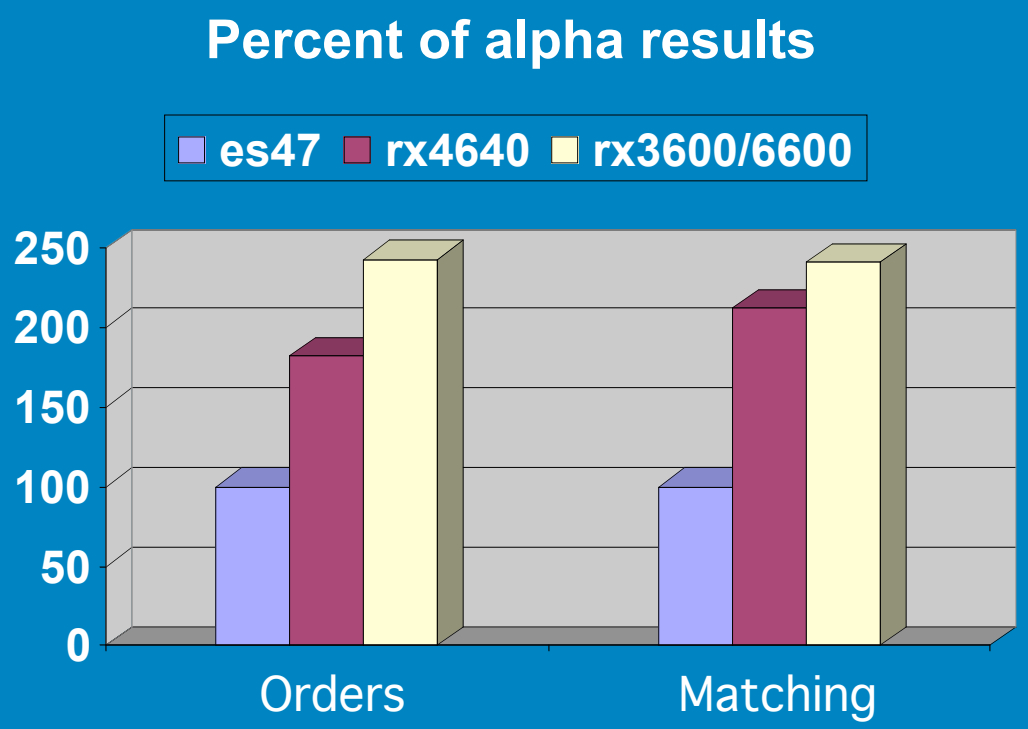
Computerized Bookmaking Systems Inc. (CBS), of Las Vegas, the largest seller of race and sports systems, recently completed a successful migration of their application software on OpenVMS from VAX to Alpha, then from Alpha servers to hp's new Integrity servers with OpenVMS. CBS runs mission-critical applications on OpenVMS due to the security and stability of the system—their customers cannot afford to experience any downtime and OpenVMS delivers the reliability they need.

Karl, Director of Research and Development for CBS, was impressed by the cost-effectiveness of Itanium, so instead of migrating their VAX customers to Alphas, he decided to migrate them directly to Integrity. "When compared to the Alpha platform, the cost of buying Itanium is less for the same performance," he said. "Alpha has served us very well, but Itanium is definitely the choice for future growth."

COMPUTERIZED BOOKMAKING SYSTEMS, INC.

RACE & SPORTS WAGERING SYSTEMS

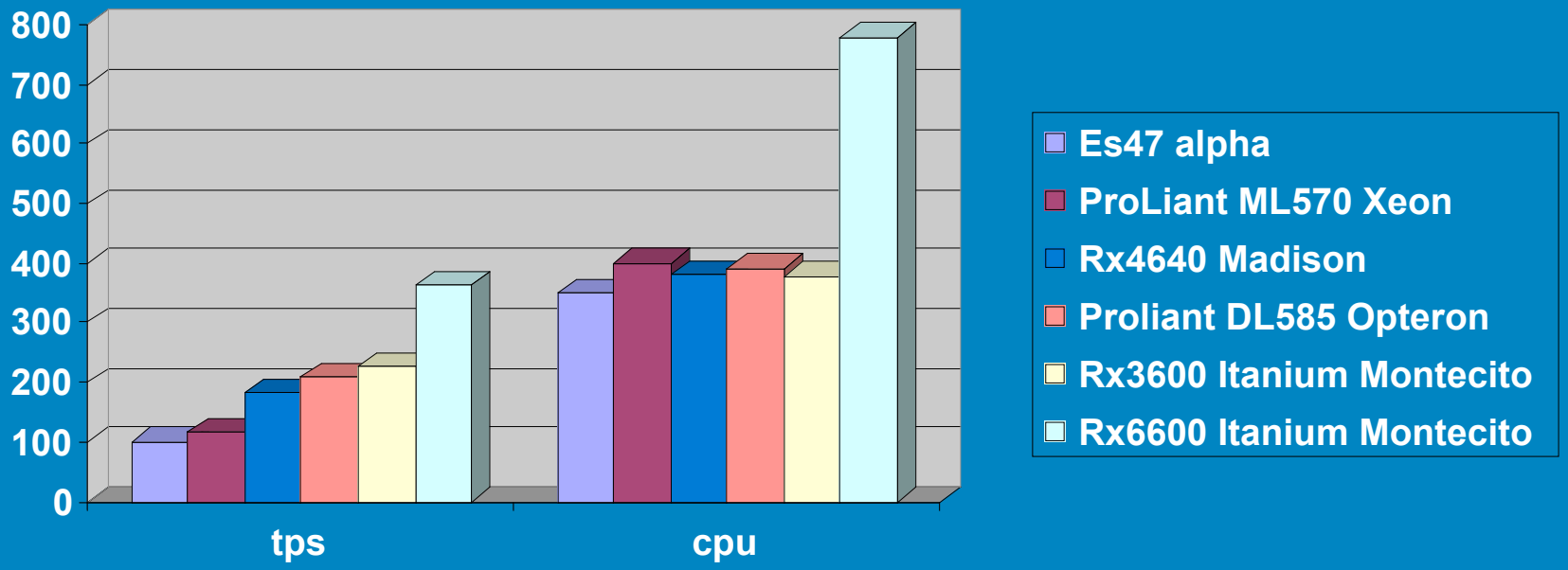
Alpha v Integrity Testing



Essentially the “Madison” based system offered approximately 100% improvement per partition, and the “Montecito” based system over 140% improvement per partition

Alpha v Integrity v Commodity hardware

Quotes processed expressed as a percentage of alpha



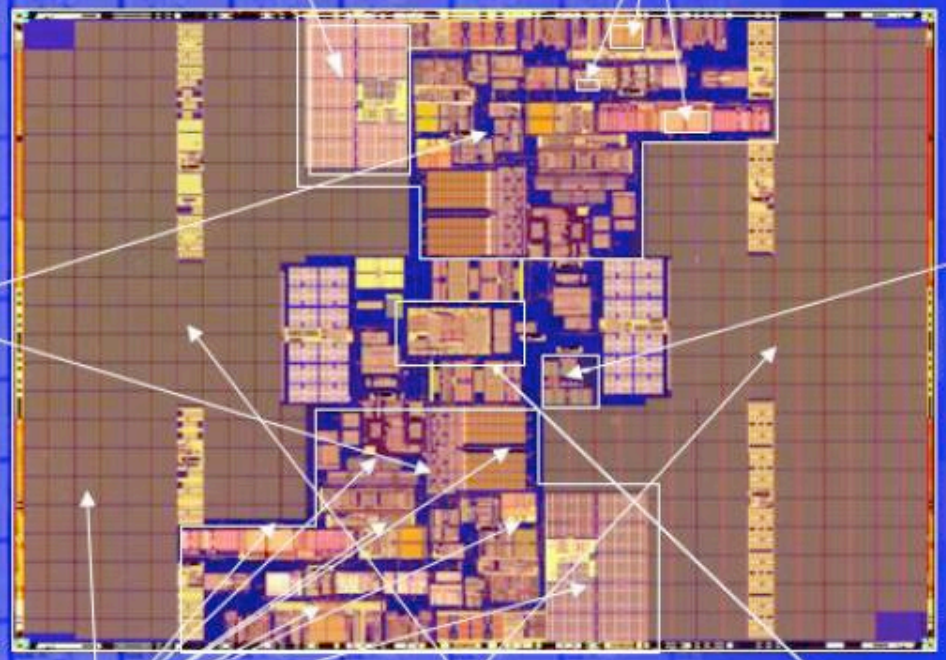
Today the Itanium based servers are essentially on the same price/performance curve as the x86 based servers for this electronic trading application. The explanation is that Enterprise server class machines, requires essentially the same structure with redundant power supplies, hot plug capabilities, large and Fast ECC memories, thus the CPU chip is a fairly small fraction of he total system cost.

Backup Slides

Integrity/Itanium Momentum

- Montecito awarded “Best Server Processor of 2004” by Microprocessor Report.
- HP shipped over $1B Integrity servers in 2004
- Full range of products 2-Socket through 64-Socket Superdome available (Blades coming)
- Shipping OpenVMS on Integrity in addition to HPUX, Linux, Windows.
- Integrity is a significant portion of our growing Business Critical Server business
  - Units and revenue are strong

Introducing Montecito



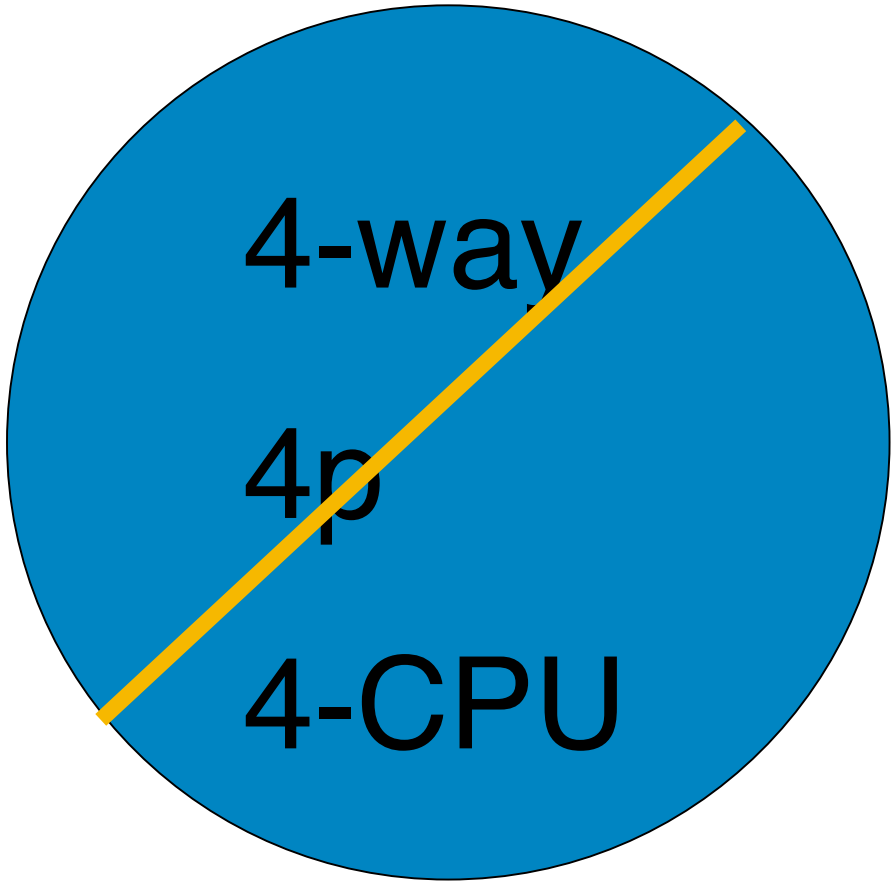
MICROPROCESSOR REPORT ANALYSTS' CHOICE
Best Server Processor
Intel Montecito

Multiple cores and Multiple threads

HW Terminology – Processors/Cores

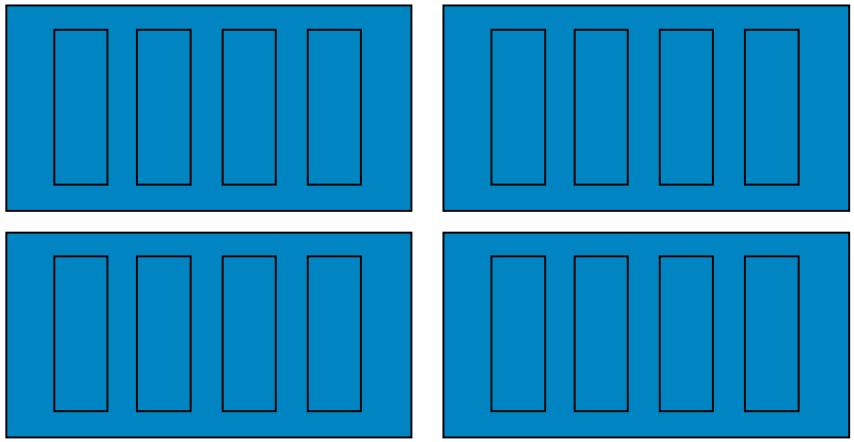
- The next IPF chip generation, named Montecito, has 2 cores per processor
- Old terminology – used “socket” to indicate CPU capacity of a system. A socket is where you can plug in a chip from Intel. rx2600 is a 2 socket system.
- BCS Marketing has invented Processor/Core terminology. A “processor” is the chip that we get from Intel and can contain 1 or more computing cores.
- The Madison rx2600 is 2P/2C
- Upgrading to Montecito will make it 2P/4C

Summary

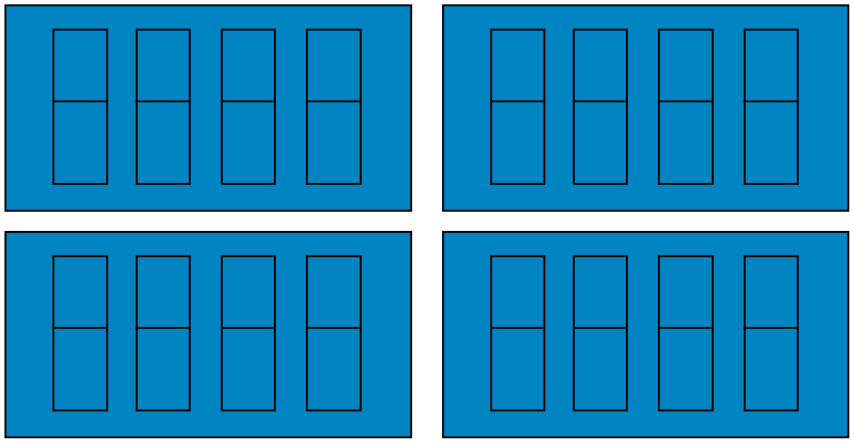


4P/nC

Madison rx8620: 4 cells, 16P/16C



Monte rx8640: 4 cells, 16P/32C



Average Memory Latency

- Today
  - GS320 (8-cell, 32P/32C, 1.2GHz)
    - (1/8 *x* 300) + (7/8 *x* 900) = **825 nsec**
  - Superdome (8-cell, 32P/32C, 1.5GHz, 6MB)
    - (1/8 *x* 246) + (3/8 *x* 413) + (1/2 *x* 463) = **417 nsec**
  - GS1280 (mesh, 32P/32C, 1.3GHz, 1.75MB)
    - (long set of numbers) = **225 nsec**
- Arches/Montecito
  - xxxx (4-cell, 16P/32C, 1.6 GHz, 12MB)
    - (1/4 *x* 185) + (3/4 *x* 360) = **316 nsec**
- In comparison, core density, more memory, faster clock speed, and much larger cache contribute to reducing memory latency differences

Performance – hardware

- The Integrity Processors are fast
  - Future processors will continue to increase the performance over current Alpha processors
- I/O performance is comparable between Alpha and Integrity
  - Integrity has an edge in CPU cost per I/O and in cached and DECram I/O
- The rx46xx and rx26xx systems have great memory bandwidth and good memory latency
  - In most cases, these systems perform similar or better than comparable Alpha systems today
- The larger Integrity servers have slower memory latency
  - If your application taxes a large GS1280, we recommend testing on larger Integrity servers before moving performance critical applications
  - Even so, RAD support is off on Integrity because the difference between local and remote access is too small

Performance - software

- The OpenVMS operating system performs well on Integrity servers with just a few caveats
  - alignment faults – apps as well as OS need to eliminate them
  - exception handling – we are working on significant improvements
- Each OpenVMS release shows performance improvements over the previous – 8.0, 8.1, 8.2, 8.2-1, 8.3……
- We expect most applications to perform well on Integrity servers today and even better in the future
  - If you port an application and are disappointed in performance, we want to know.
    - Please contact:

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