

# Competitive Update Against HP and Oracle/SUN



IBM Power Systems



## IBM Power Systems with POWER7

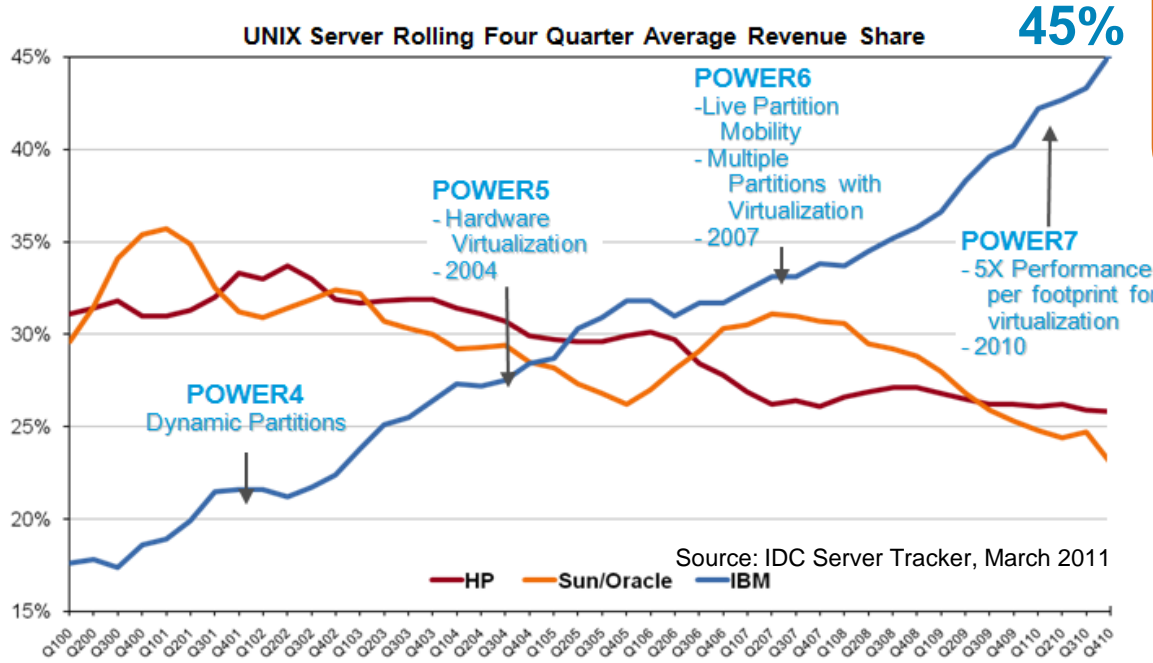
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# IBM's ten-year march to UNIX leadership

*The largest shift of customer spending in UNIX history*

# 3,500+

Successful Power migrations to date.

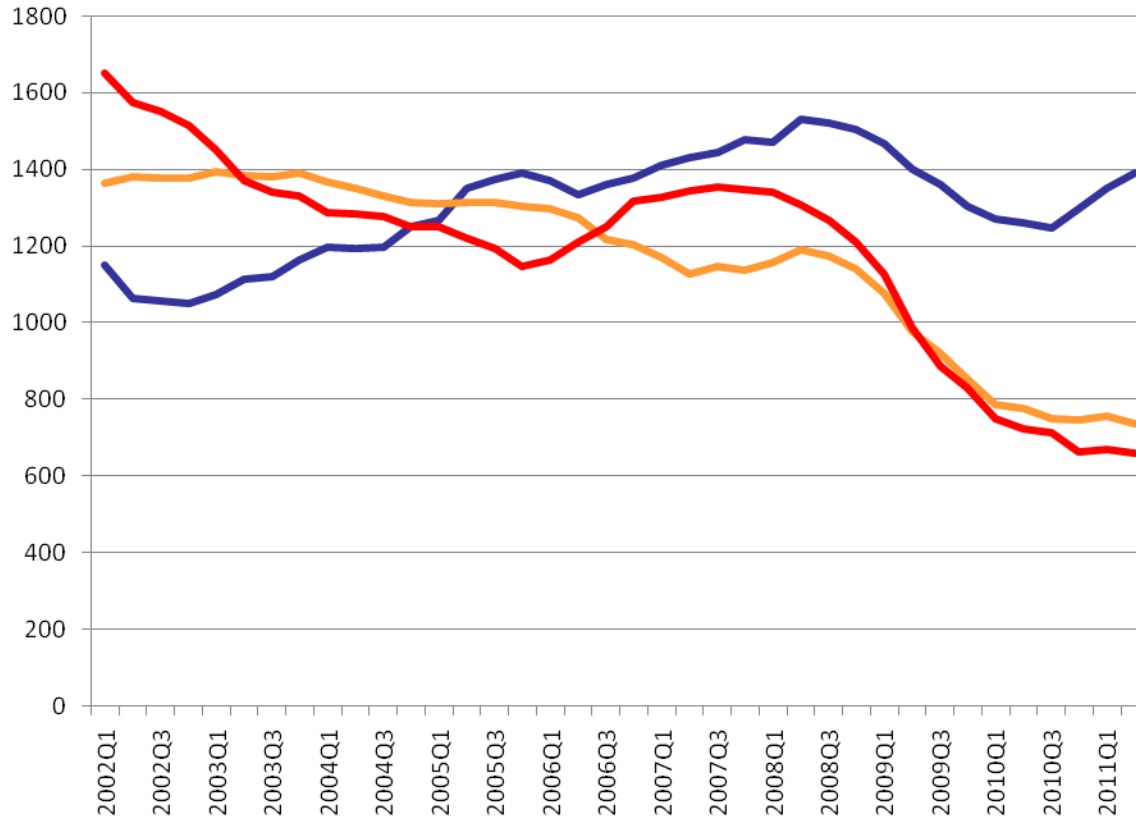


<http://www.ibm.com/systems/migratetoibm/factory/>

- The pace is accelerating & exceeding expectations: 500+ migrations to Power in 2009, over 1,000 in 2010
- Over 90% come from HP-UX or Oracle Solaris, along with x86 consolidations
- POWER grew 5% in 4Q10, to 45% market share

# Numbers don't lie

## Ten Year Unix Systems Revenue - 4QRA



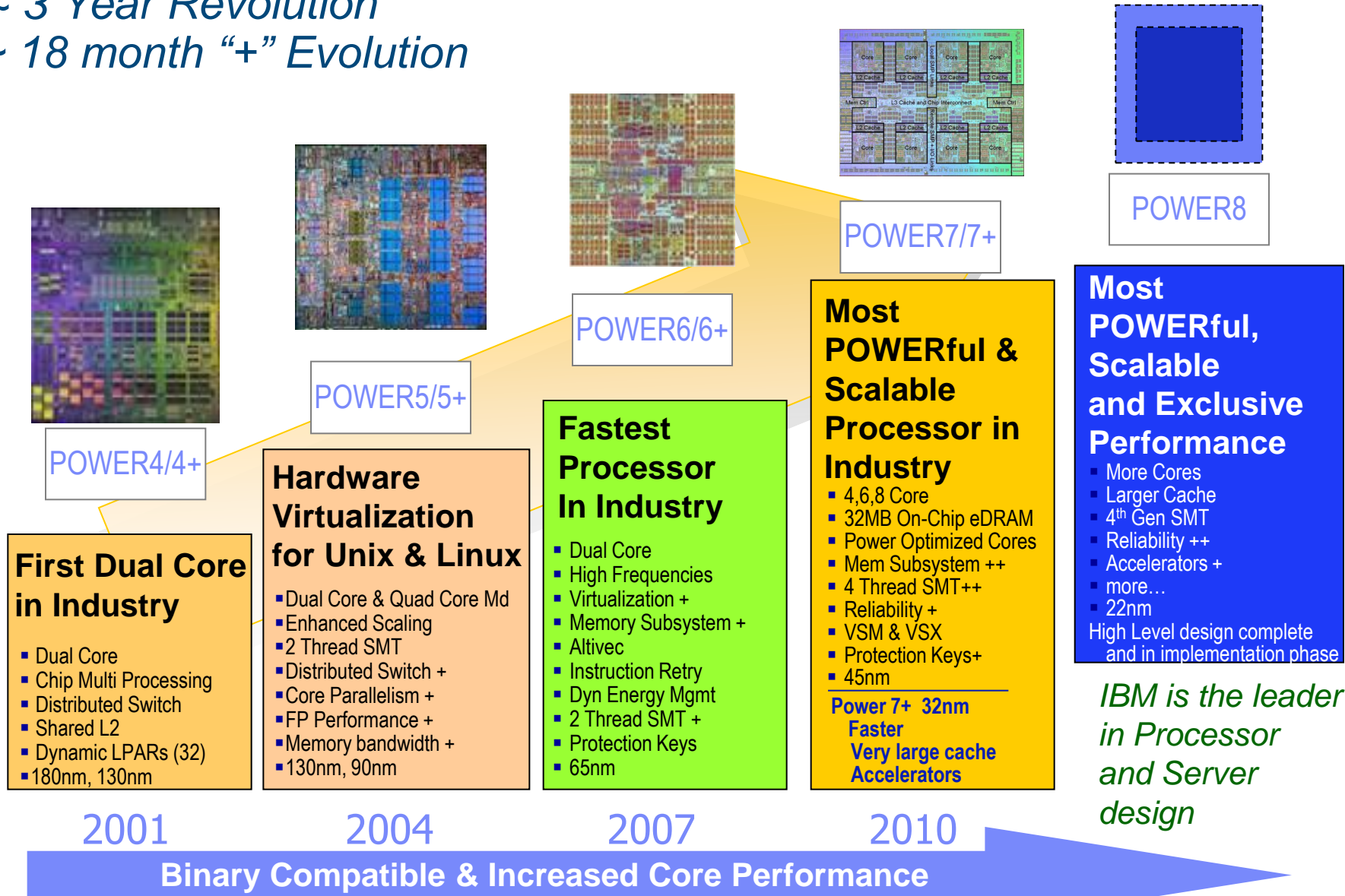
<b>2011 Q2</b>	
<b>IBM</b>	<b>\$1.375B</b>
<b>Oracle</b>	<b>\$719M</b>
<b>HP</b>	<b>\$644M</b>

- IBM
- Hewlett-Packard
- Sun/Oracle

**IBM is a growth platform with rising star increased investment**  
**HP and Sun continue decline with cash cow divest strategy**

# IBM POWER Processor Roadmap

~ 3 Year Revolution  
 ~ 18 month "+" Evolution



## Oracle SPARC/Solaris Pain Points



- SPARC split-personality problem makes it difficult to position and sell
- No capacity-on-demand or utility pricing immediately hands that conversation over to IBM
- Very rudimentary virtualization capabilities are insufficient for systems with many cores and threads
- Poor per-core performance keeps ISV licensing costs high
- Upcoming Solaris 11 migration will be an administrative nightmare, and breaks Sun's legendary binary compatibility contract for the first time in 20 years
- SPARC/Solaris market share has been plummeting: for the last two years, SPARC hasn't been selling as well as Itanium!

# SPARC Has a Split-Personality Problem

UltraSPARC-based  
CMT Servers  
a.k.a. "T-series"



**T3-1B**



**T3-1**



**T3-2**



**T3-4**

- UltraSPARC-T3 designed by Oracle and manufactured by TSMC for highly-threaded, stateless, throughput workloads: web and application tier; chip multi-threading ("CMT")
- Each socket has cryptographic, memory, 10GbE, and PCIe control on-chip
- Virtualization through Oracle VM for SPARC, formerly called "Virtual domains" (LDOMs)

SPARC64-based  
Enterprise Servers  
a.k.a. "M-series", "APL", "OPL"



**M3000**



**M4000**



**M5000**



**M8000**



**M9000-  
32**

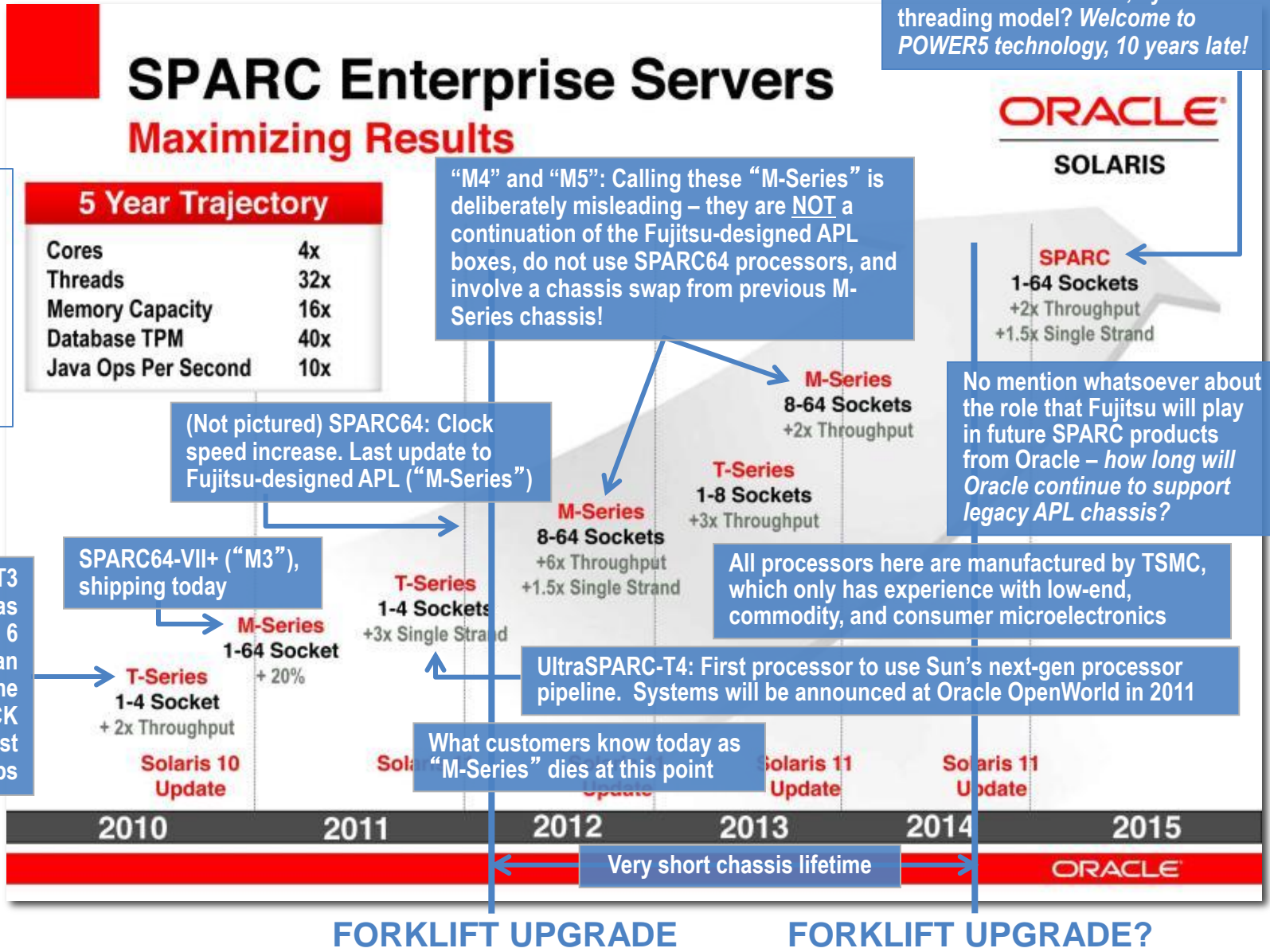


**M9000-  
64**

- Systems designed by Fujitsu under the Advanced Product Line ("APL") contract with Sun
- SPARC64-VII+ microprocessor designed by Fujitsu and manufactured by TSMC
- Designed for single-threaded, latency-driven workloads: DW, BA, large OLTP, SMT



# SPARC Roadmap: Wh you need to know



No more "M-Series"/"T-Series": Is this a new combined, dynamic threading model? Welcome to POWER5 technology, 10 years late!

All trajectory comparisons are wishful objectives done relative to Sun's existing SPARC baseline, not to POWER or x86! IBM and Intel blow SPARC away today, does Oracle think that the competition will stand still for the next five years?

"M4" and "M5": Calling these "M-Series" is deliberately misleading – they are NOT a continuation of the Fujitsu-designed APL boxes, do not use SPARC64 processors, and involve a chassis swap from previous M-Series chassis!

No mention whatsoever about the role that Fujitsu will play in future SPARC products from Oracle – how long will Oracle continue to support legacy APL chassis?

UltraSPARC-T3 processor was supposed to be 6 months earlier than this due to the cancellation of ROCK when Sun last showed roadmaps

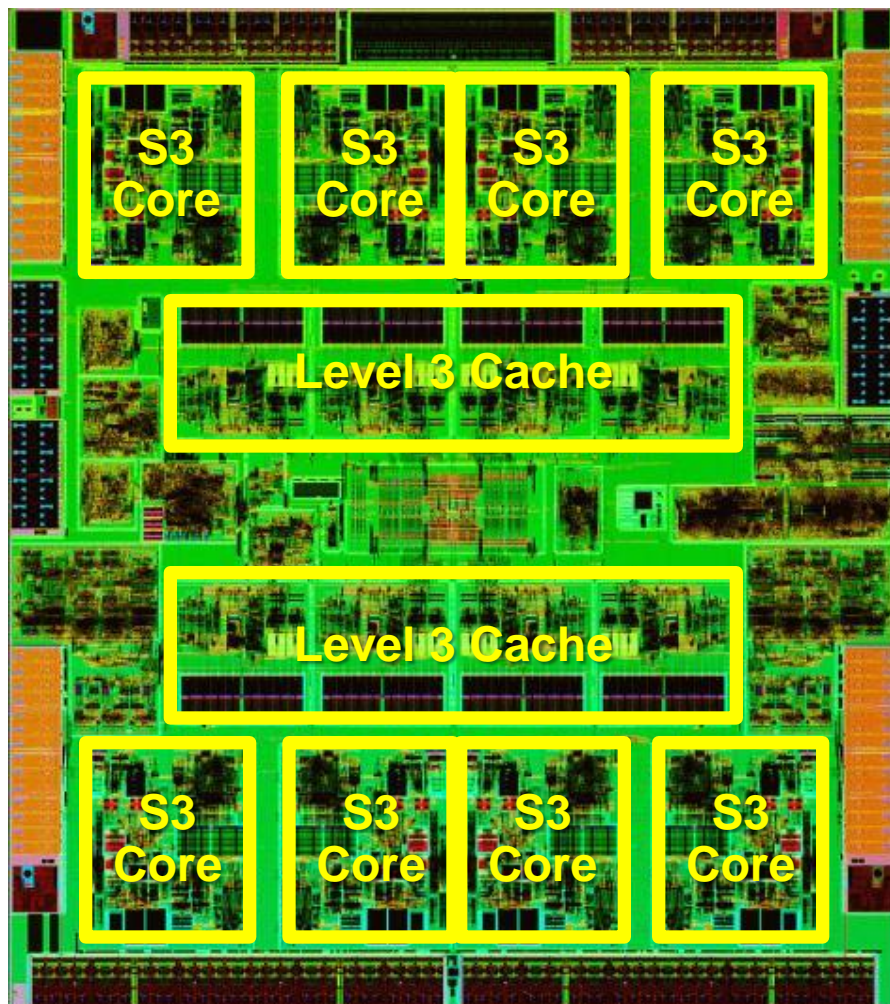
(Not pictured) SPARC64: Clock speed increase. Last update to Fujitsu-designed APL ("M-Series")

All processors here are manufactured by TSMC, which only has experience with low-end, commodity, and consumer microelectronics

UltraSPARC-T4: First processor to use Sun's next-gen processor pipeline. Systems will be announced at Oracle OpenWorld in 2011

What customers know today as "M-Series" dies at this point

# UltraSPARC-T4

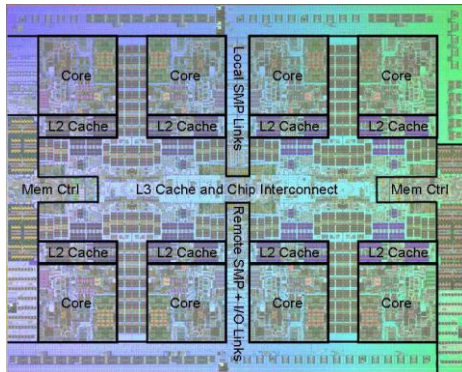


- A transitional SPARC processor based on a new “S3” (formerly “VT”) core, pin-compatible with T3
  - Only the cores and L3 cache changed
  - Half the number of cores vs. T3
  - The rest of the chip is identical to T3
  - Designed for fast time-to-market
- Designed specifically for multi-threaded, throughput-oriented workloads like web and app servers
  - Many cores and threads
  - Very small caches
  - Will probably handle small or medium OLTP workloads reasonably well
  - Definitely not suited for data warehousing or business analytics
- However, Oracle will position T4 systems as a general-purpose computing platform suitable for a growing variety of workloads



# IBM Power7 vs. Fujitsu SPARC64 APL

## IBM Chip Technology Lead



8X



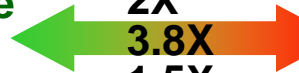
### IBM POWER7

- 45nm
- Octo Core
- 4GHz
- 32MB eDRAM L3
- 4 Simultaneous Threads / Core
- 2GHz Distributed Switch
- DDR3
- Scale to 32 Sockets
- Virtual Machines >1000 threads
- Extensive Reliability features

### Fujitsu SPARC64 VII+ (Last chip)

- 65nm
- Quad Core (four SPARC64VI cores)
- 3GHz
- L2 12MB, no L3
- 2 Simultaneous Threading
- 530MHz interconnect
- DDR2
- Scale to 64 Sockets
- No built in virtualization
- Reliability based on HW partitions
- \*No future chips\*

2X  
1.3X  
2.6X  
2X  
3.8X  
1.5X

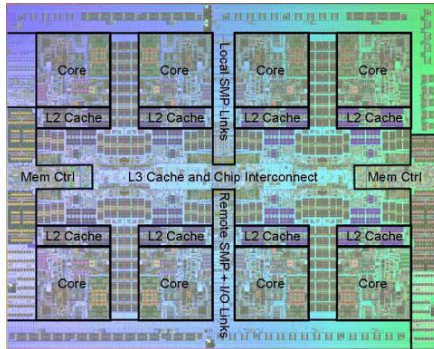


**IBM POWER is the undisputed leader  
in server technology**

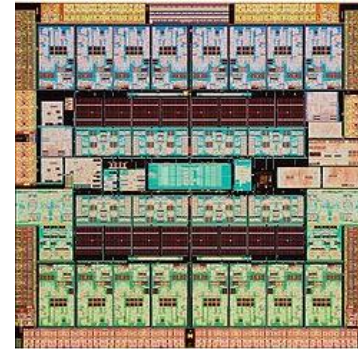


# IBM Chip technology vs. Oracle SPARC CMT T4

## IBM Chip Technology Lead



2-4X



### IBM POWER7 - 2010

- 45nm
- Octo-core
- 4GHz
- 2 GHz Interconnect
- L2 2MB, L3 32MB
- 4 - Simultaneous Multi-Threading
- Scale to 32 Sockets / 256 Cores
- Hardware Virtualization
- Switch on every chip with direct connection fabric



### Sun SPARC T4

- 40nm
- 8 Simplified cores
- 3GHz
- ?MHz interconnect
- L2 128KMB, L3 4MB
- 8 - Sharing Threads
- Scale to 4 Sockets, 32 cores
- Limited Thread based partitioning

IBM POWER is the undisputed leader  
in server technology

# UltraSPARC-T4 / POWER7 Chip Comparison

	UltraSPARC-T4	POWER7
<b>Cores, Clocks, and Sockets</b>	<ul style="list-style-type: none"> <li>8 cores @ ~3GHz, 40nm</li> <li>4-way socket scalability</li> </ul>	<ul style="list-style-type: none"> <li>8 cores @ 2.4-4.1GHz, 45nm</li> <li>TurboCore / MaxCore configurations</li> <li>32-way socket scalability</li> </ul>
<b>Thread Model</b>	<ul style="list-style-type: none"> <li>Chip Multithreading (CMT)</li> <li>64 CMT threads / socket</li> </ul>	<ul style="list-style-type: none"> <li>Symmetric Multithreading (SMT)</li> <li>32 SMT threads / socket</li> </ul>
<b>Thread Enhancements</b>	<ul style="list-style-type: none"> <li>Critical Thread API</li> <li>Dynamic threads</li> </ul>	<ul style="list-style-type: none"> <li>SMT/SMT2/SMT4</li> <li>Intelligent threads</li> </ul>
<b>Cache</b>	<ul style="list-style-type: none"> <li>16K L1 I&amp;D caches / core</li> <li>128K L2 unified I&amp;D cache / core</li> <li>4MB L3 / <u>socket</u> SRAM</li> </ul>	<ul style="list-style-type: none"> <li>32K L1 I&amp;D caches / core</li> <li>256K L2 unified I&amp;D cache / core</li> <li>4MB L3 / core; 32MB L3 shared eDRAM</li> </ul>
<b>Virtualization</b>	Hypervisor-based Oracle VM for SPARC, a.k.a. Logical Domains: Rudimentary partition mobility	Hypervisor-based PowerVM™: Live Partition Mobility, Micropartitions, Shared Processor Pools, Active Memory Sharing, Active Memory Expansion
<b>Power and RAS</b>	No memory mirroring, no ChipKill, no power save or capping options	Active Memory Mirroring for Hypervisor, ChipKill™, EnergyScale™ dynamic power save and capping
<b>Additional</b>	<ul style="list-style-type: none"> <li>PCIe, 10GbE, crypto functions exactly the same as on T3</li> <li>2 DDR3 memory controllers, ~50GB/socket</li> </ul>	2 DDR3 memory controllers, 90GB/socket

***SPARC is still seriously behind POWER, and POWER isn't standing still***

## Itanium-based systems are in the news, again

Recent developments in the Itanium market have put HP's customers in a precarious position and created an opportunity for IBM and its partners to capture new opportunity ...

The logo for PCWorld, featuring the word "PCWorld" in white text on a red rectangular background.

December 2009

[Red Hat to Drop Itanium Support](#)



April 2010

[Microsoft Dropping Support for Intel's Itanium chip](#)



March 2011

[Oracle's Move To End Itanium Support May Hurt HP](#)

The logo for Oracle, featuring the word "ORACLE" in red, uppercase letters.

March 2011

[Oracle Stops All Software Development For Intel Itanium Microprocessor](#)

***“On Oracle dumping Itanium: ... In a report that I wrote last April I said: ‘If I’m running an Oracle database, Oracle infrastructure, or Oracle business applications, I’d be a little concerned about the kind of support and tuning I’d be getting from Oracle on Itanium in the long run.’ It is time to dump Itanium ...”***

-- Joe Clabby, President [Clabby Analytics](#), April 2011



# HP's new Integrity Servers

*HP stresses commonality as capability continues to lag*

Integrity Server  
Blades



- 27% better performance per core than previous 32-core Integrity servers
- 50% of the performance of a 32-core Power 750

Superdome 2



- 13.7% better performance per core than previous 64-core SuperDome on TPC-H
- 128-core in 1H2011, 256-core ?
- 16-core HP VMs in 1H2011

# Migrating HP Integrity to the Power Express Family

## HP Integrity Server Blades



## IBM Power Express Family

*The highest performing, most energy efficient systems in the industry*



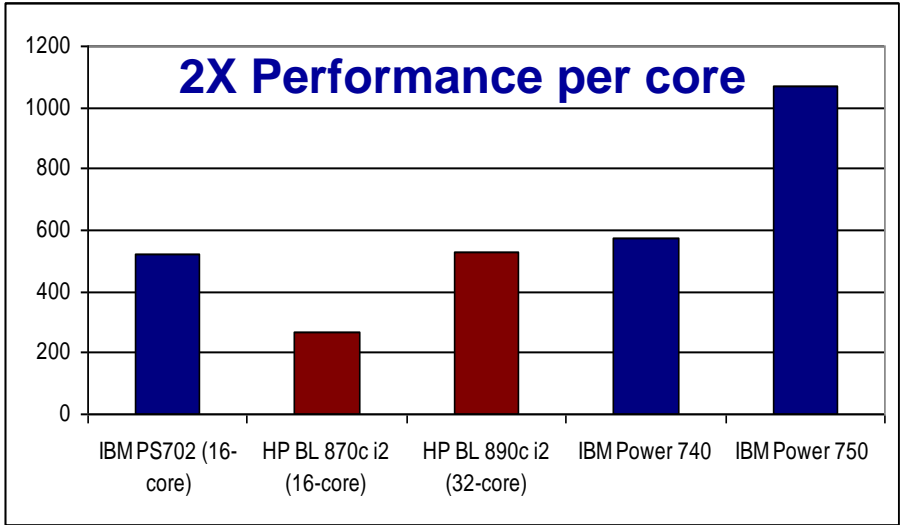
**Power 750**  
*Modular growth through processor card upgrades*



**Power 720/740**  
*Choice of footprint, more performance at lower price*



**Power 710/730**  
*High performance, dense and energy efficient*



Based on SPECint\_rate results as of 7/24/2010. Power 740 results based on projections.

[www.spec.org](http://www.spec.org)



## Power Blades

*Blade vs. Blade with similar performance in 1/2 the cores and density.... at a fraction of the price*

# More SAP performance than any system in the industry

20% more performance ... one-fourth the number of cores vs. Sun M9000

# 37,000

SAP users on SAP SD 2 Tier

40,000

**#1**  
Overall

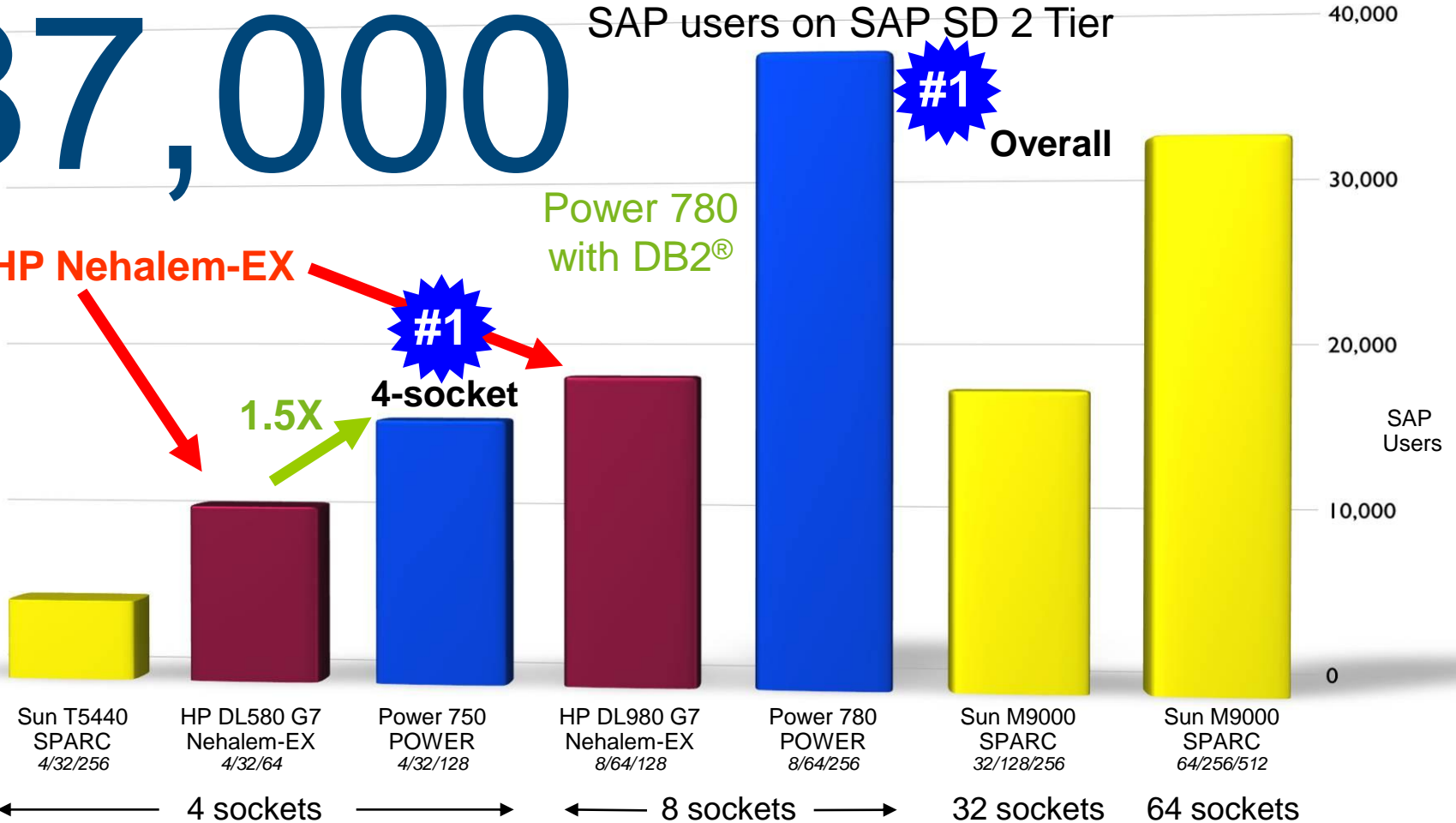
Power 780  
with DB2®

New HP Nehalem-EX

**#1**

1.5X

4-socket



Systems are listed with processor chips/core/threads under system name; IBM Power System 780, 8p / 64-c / 256-t, POWER7, 3.8 GHz, 1024 GB memory, 37,000 SD users, dialog resp.: 0.98s, line items/hour: 4,043,670, Dialog steps/hour: 12,131,000, SAPS: 202,180, DB time (dialog/ update):0.013s / 0.031s, CPU utilization: 99%, OS: AIX 6.1, DB2 9.7, cert# 2010013; SUN M9000, 64p / 256-c / 512-t, 1156 GB memory, 32,000 SD users, SPARC64 VII, 2.88 GHz, Solaris 10, Oracle 10g, cert# 2009046; All results are 2-tier, SAP EHP 4 for SAP ERP 6.0 (Unicode) and valid as of 7/13/2010; Source: <http://www.sap.com/solutions/benchmark/sd2tier.epx> - See Power 780 benchmark details for more information

# Inflection Point: Oracle Is Forcing a Migration on Their Customers

## Existing SPARC on Solaris 8/9/10



- Well-understood, existing system administration skills
- Binary compatible with existing software

Oracle's preferred migration path

If the customer absolutely insists

### Exadata



- Very disruptive migration
- Small/medium/large only
- No re-use of existing storage
- No integration into existing backup infrastructure
- Workload optimized for nothing in particular, no virtualization
- Very poor market acceptance: only 1000 "installed" after 3 years of sales<sup>[1]</sup>

### Solaris 11 on SPARC



- Solaris 11 is an entirely new operating system, inside and out
- Major administrative changes around file system management, networking, and software and patching infrastructure
- Binary compatibility breaks<sup>[2]</sup>
- Plummeting market share: *Itanium* has been out-selling SPARC for the last two years<sup>[3]</sup>

[1] Oracle president Mark Hurd: [http://www.thestreet.com/\\_nasdaq/story/11164061/1/oracle-beats-but-hardware-sales-disappoint.html?&cm\\_ven=nasdaq&cm\\_cat=free&cm\\_ite=na](http://www.thestreet.com/_nasdaq/story/11164061/1/oracle-beats-but-hardware-sales-disappoint.html?&cm_ven=nasdaq&cm_cat=free&cm_ite=na)

[2] <http://www.oracle.com/technetwork/systems/end-of-notice/eonsolaris11-392732.html>

[3] Source: IDC Server Tracker, 2009-2011



# 10 Reasons IBM POWER7 Systems are Better for Oracle

	IBM POWER7® Systems	Oracle Exadata
1. Configuration and price flexibility	Custom, client-focused configurations for multiple needs – including OLTP and Data Warehouse – and multiple price points	Rigid configuration with lack of customization to client's workload with a high initial purchase price that is very expensive to scale
2. Storage technology	Enterprise-strength storage technologies such as RAID-6	Missing key storage technology and options support
3. Performance	Industry-leading performance and benchmarks	No published benchmarks
4. Scalability	Capability and flexibility to scale up and scale out	Only scale-out capability
5. Reliability	Extremely reliable system and storage technology	Uncertain reliability
6. Virtualization	Marries resource efficiency and virtualization	No virtualization
7. OS flexibility	Choice of AIX®, IBM i, Red Hat or SUSE Linux	Only proprietary Oracle Linux distributions, Oracle Solaris 11 in 2011
8. Software levels	Supports all currently available Oracle Database Server versions through 11gR2	Only supports Oracle Database Server 11gR2
9. Roadmap	History of success and a clear roadmap	Uncertain roadmap and direction
10. Business risk	Proven platform	Risky platform

**Oracle...**  
**1. Expensive**  
**2. Lock in**  
**3. Risk**

# OLTP and Data Warehouse Have Different Design Needs

IBM believes that designing and building systems optimized for specific workloads is the best approach

## ■ OLTP Systems

- Run the business by processing the transactions that are critical to the organization
- Utilization is driven by the number of users, not complexity of SQL
- Smaller block I/O – 8K
- Higher write - updated online, many index lookups
- Buffer, log and cache management are key to performance in clusters

## ■ Data Warehouse Systems

- Analyze the transaction data to provide strategic and competitive differentiation
- Larger more complex queries with more table joins, complex SQL
- Lots of large block I/O – 16-32K
- 90-95% reads
- Tends to consume entire environments

## ■ Mixing OLTP and Data Warehouse databases within the same OS is not generally recommended

Would you configure OLTP and Data Warehouse systems identically?  
**ORACLE DOES with Exadata!**

# Power is Workload Optimization

**Power Systems™ Express servers offers balanced systems designs that automatically optimize workload performance and capacity at either a system or VM level**

- ✓ **Intelligent Threads** utilize more threads when workloads benefit
- ✓ **Intelligent Cache** technology optimizes cache utilization flowing it from core to core
- ✓ **Intelligent Energy Optimization** maximizes performance when thermal conditions allow
- ✓ **Active Memory™ Expansion** provides more memory
- ✓ **Solid State Drives** optimize high I/O access applications



**Workload-Optimizing Features make POWER7 #1 in Transaction and Throughput Computing**

# Implement Lower-Cost Solutions Suited to Your Business Needs

*IBM POWER7 Systems offer custom, client-focused configurations for YOUR specific workload with choice of processor speed, storage type, virtualization and the ability to scale both up and out!*



*— IBM POWER7 Systems —  
Flexibility for OLTP and Data Warehouse Workload deployment*



*Upgrade existing systems OR integrate new systems into your environment based on your workload needs*

*Leverage virtualization in application servers and development/test environment*



# POWER7 Leads Exadata in All Platform Categories

	Exadata X2-2	Exadata X2-8	Power Systems
Sockets/Node	2	8	1 to 32
Cores/Node	12	64	4 to 256
Max Cores/Rack	96	128	256 with 795 320 with 730/750 448 with PS701 blades
Threads/Node	24	128	16 to 1024
Memory/Node	96 GB	1TB	Up to 8TB
OS Support	Oracle Linux, Solaris 11	Oracle Linux, Solaris 11	AIX, IBM i, Red Hat and SUSE Linux
Oracle DB Support	11gR2	11gR2	10gR2, 11gR1, 11gR2
Virtualization	None	None	IBM PowerVM™ built in
VMs/node	None	None	Up to 1,000

*IBM POWER7 Systems are the wise choice to run Oracle Database software. Make the smart decision!*



## POWER7 is Reliable. Is Exadata?

RAS Feature	POWER7	EXADATA X2-2	EXADATA X2-8
Live Partition Mobility	Yes	No	No
Live Application Mobility	Yes	No	No
OS-independent First Failure Data Capture with dedicated service processors	Yes	No	No
Memory Keys (including OS exploitation)	Yes	No	No
Voltage Regulator Output Redundancy – N+2	Power 770/780	No	No
Processor Instruction Retry	Yes	?	?
Alternate Processor Recovery	Yes	No	No
Dynamic Processor De-allocation	Yes	?	?
Dynamic Processor Sparing	Yes	?	?
Hypervisor Critical Data Memory Mirroring	Yes	?	?
Dynamic DRAM Sparing	Yes	?	?
I/O Extended Error Handling	Yes	?	?
I/O Adapter Isolation (PCI-Bus and TCEs)	Power 770/780/795	?	?

# “Superclusters”: The Appliance Model for SPARC Begins

## Compute Nodes

- Choice of SPARC T3-2, T3-4, or M5000 servers

## Storage Servers

- Sun ZFS Storage 7420 Appliances

## InfiniBand QDR Unified Server and Storage Network

## Software Included

- Oracle Solaris 10 9/10 (U9)

## Software Not Included

- Clustering software
- Everything else



- Oracle announced “Gold Standard Configurations” on December 2, 2010
  - The rest of the industry calls these “reference configurations”
  - Designed to save Oracle maintenance costs, not to benefit clients
- Oracle claims it’s a general-purpose compute platform ...
- ... True, because it’s just a bunch of servers in a rack! No special software
- Nothing you cannot do à

<http://www.oracle.com/us/solutions/spark/superclusters/191672.pdf>

# Solaris 11 Migration Impacts Systems Administrators

What Changes	Impact
<p>Forced migration from UNIX File System (UFS) to ZFS: all system directories (/ , /usr, /var, /opt, etc.) now must be on ZFS</p>	<ul style="list-style-type: none"> <li>• Many customers do not yet use ZFS</li> <li>• ZFS management requires new administrative skills</li> <li>• Administrative scripts that use UFS tools (newfs(1M), snapfs(1M), fsck(1M), etc.) must be rewritten</li> <li>• ZFS has poor write performance due to its copy-on-write architecture, so performance on update-intensive directories like /var, /var/tmp, or /tmp may suffer</li> </ul>
<p>All software installation, patching, and management is now done through the new Image Packaging System (IPS)</p>	<ul style="list-style-type: none"> <li>• IPS requires new administrative skills</li> <li>• pkgadd(1M), pkgrm(1M), etc., are present but cannot manage the primary package database</li> <li>• Third-party configuration management and provisioning tools will need to be updated to support IPS</li> <li>• Entirely new image repository infrastructure may need to be set up behind firewalls for the security-conscious</li> </ul>
<p>Support for legacy UltraSPARC I, II, IIe, III, IIIi, III+, IV and IV+ has been dropped</p>	<ul style="list-style-type: none"> <li>• Systems administrators will need to operate two different patch and configuration management infrastructures or face swapping out all legacy SPARC gear at once</li> </ul>

<http://www.oracle.com/technetwork/systems/end-of-notice/eonsolaris11-392732.html>



# Solaris 11 Migration Impacts Systems Administrators

What Changes	Impact
<p>The entire networking administrative interface (wificonfig(1M), /etc/hostname.*, etc.) has changed</p>	<ul style="list-style-type: none"> <li>• Systems administrators will need to learn the new dladm(1M), ipadm(1M), routeadm(1M), etc. interfaces</li> <li>• Administrative scripts based on manipulating the old files will break</li> </ul>
<p>Support for xVM hypervisor has been removed</p>	<ul style="list-style-type: none"> <li>• Systems administrators will be forced to migrate to Oracle VM Server for x86 or Oracle VM Virtualbox</li> </ul>
<p>Support for many SCSI, RAID, and ethernet adapters has been dropped</p>	<ul style="list-style-type: none"> <li>• Systems administrators may need to purchase and install newer adapters</li> </ul>
<p>The LP print subsystem has been replaced by CUPS</p>	<ul style="list-style-type: none"> <li>• Administrators unfamiliar with CUPS (for example, from Linux) will require new administrative skills</li> <li>• Scripts based on the LP system will break</li> </ul>
<p>sysidtool(1M), sys-unconfig(1M), etc. have been removed</p>	<ul style="list-style-type: none"> <li>• Systems administrators will have to learn to do Solaris identification and configuration through the Service Management Facility (SMF)</li> <li>• Existing JumpStart profiles will have to be scrapped</li> </ul>

<http://www.oracle.com/technetwork/systems/end-of-notice/eonsolaris11-392732.html>

# Solaris 11 Migration Impacts Developers

What Changes	Impact
MySQL 5.0 support has been dropped	<ul style="list-style-type: none"> <li>• Developers must migrate and re-certify to MySQL 5.1 or to the Oracle database</li> </ul>
PostgreSQL support has been dropped entirely	<ul style="list-style-type: none"> <li>• Developers must find another database (guess which one Oracle will recommend?)</li> </ul>
OpenGL support for SPARC has been removed	<ul style="list-style-type: none"> <li>• Developers must go to third parties for headers, libraries, and support or code to a different interface</li> </ul>
The widely-used rdist(1M) utility, popular for synchronizing development environments, has been removed	<ul style="list-style-type: none"> <li>• Developers must find alternatives</li> <li>• Scripts used for configuration management may break</li> </ul>
Many development libraries (see following slide) have been removed	<ul style="list-style-type: none"> <li>• Developers must find alternatives and re-write their code</li> </ul>
Command-line options for many utilities like sort(1) and vi(1) have changed; some commands like crypt(1) have been eliminated	<ul style="list-style-type: none"> <li>• Shell scripts may break, either catastrophically or (worse) silently</li> </ul>

<http://www.oracle.com/technetwork/systems/end-of-notice/eonsolaris11-392732.html>

# Solaris 11 Migration Breaks Binary Compatibility

What Changes	Impact
The OpenSSL interface has been upgraded from 0.9.7 to 1.0.0 (openssl.org broke this interface)	<ul style="list-style-type: none"><li>• Legacy Solaris code will no longer run natively in Solaris 11, breaking the legendary Solaris binary compatibility contract for the first time since the Solaris 1 to Solaris 2 transition of the early 1990s</li><li>• Oracle will force customers who wish to run existing troublesome binaries to run them in Solaris 10 containers, almost certainly with additional Solaris 10 licenses and maintenance, until Oracle drops support for Solaris 10 entirely in the near future</li></ul>
OpenWindows libraries and toolkits have been removed	
libmle, the multi-lingual environment library used in several input method framework and language engines, has been removed.	
The ICU (International Components for Unicode) v2 and v3 libraries have been removed	
The Remote Shared Memory API (RSM API) has been removed	
The libinetcfg library interfaces have been removed	
The Asian legacy libraries (libkle, libcle, and libhle), including their xctype macros, are no longer supported	
Solaris 1.x (SunOS 4.x) binaries will no longer run	

<http://www.oracle.com/technetwork/systems/end-of-notice/eonsolaris11-392732.html>

Don't Let Oracle Downplay the Effort Involved ...

Solaris 9 to Solaris 10  
was an **upgrade**

Solaris 10 to Solaris 11  
will be a **migration**

# AIX Binary Compatibility Guarantee



## AIX Version 6.1 Binary Compatibility



Dear System p clients:

We listened and we have delivered for you, and in fact we hope you have been ecstatic with the recent announcements on the AIX® V6.1 and POWER6™ products. Not only can the new POWER6 servers run AIX V5.2, V5.3 and AIX V6.1—with binary compatibility for many applications—but AIX V6.1 will even run on older hardware, based on POWER5™, and POWER4™ processors. This broad support for multiple levels of the AIX operating system on multiple generations of POWER systems is the strongest that we have ever had.

But some clients have said that they want to hear it from me. We've said we will offer binary compatibility and we mean it. We are offering a guarantee that your applications, whether written in house or supplied by an application provider, will run on AIX V6.1 if they currently run on AIX 5.2 or 5.3—without recompilations or modification.

Take us up on that challenge. We assume (and require) that these applications comply with reasonable programming standards (see [ibm.com/systems/p/os/aix/compatibility/conditions](http://ibm.com/systems/p/os/aix/compatibility/conditions)), but if they do and the applications will not run on AIX V6.1, contact us. We will investigate and assign our developers to work on the binary compatibility problem. I don't anticipate anyone will call but I wanted to assure you that we are committed to the binary compatibility of AIX V6.1.

The qualities of the AIX operating system—virtualization, security, performance, and quality—have won many new clients to AIX. AIX V6.1 will be the next step forward in the evolution of UNIX, while allowing many existing applications to continue to run. AIX is and will remain the strategic UNIX operating system for IBM.

Thank you for your continued confidence in IBM System p servers and in the AIX operating system. Keeping your applications up and running is one of our primary goals. I want you to rest assured that we are talking great care to insure that when you upgrade to AIX V6.1, your applications will not only run unmodified, but you will also be able to take advantage of the new innovations in AIX V6.1.

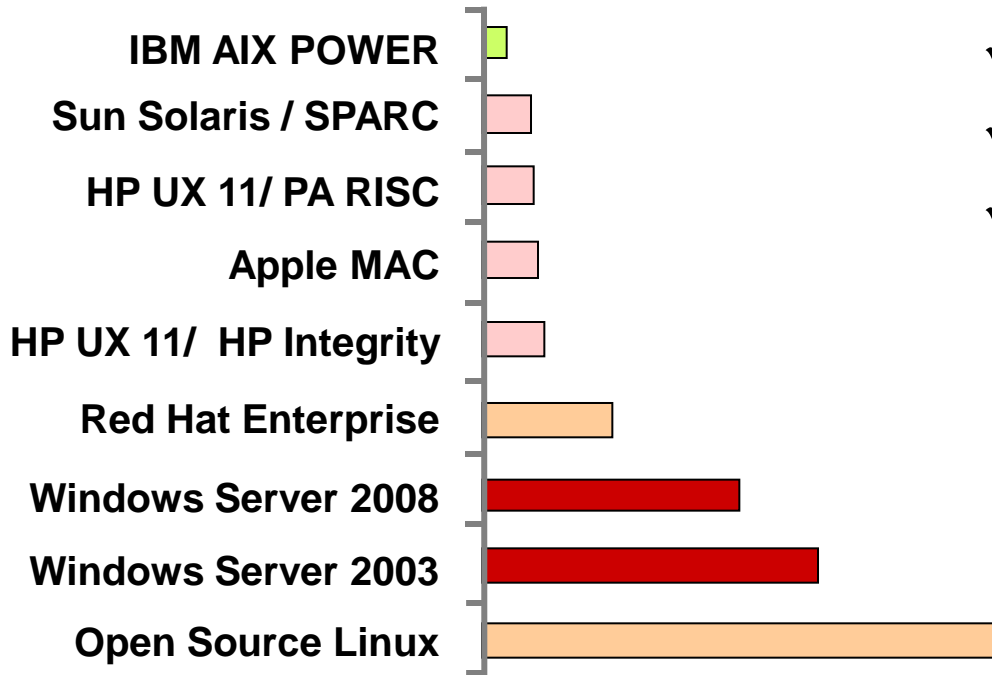
Sincerely,

Ross A. Mauri  
General Manager



# AIX on POWER is the most reliable OS among UNIX, Linux and Windows

## Corporate Enterprise Downtime (Hours per Year)



## IBM leadership

- ✓ 99.997% uptime\*
- ✓ 2.3X better than next UNIX
- ✓ >10X better than x86-based platforms



\*Source: [ITIC 2009 Global Server Hardware & Server OS Reliability Survey Results](#), July 7, 2009. Fully paper is available at [ibm.com/aix](http://ibm.com/aix)

# HP's new Integrity Servers

*HP stresses commonality as capability continues to lag*

Integrity Server  
Blades



- 27% better performance per core than previous 32-core Integrity servers
- 50% of the performance of a 32-core Power 750

Superdome 2



- 13.7% better performance per core than previous 64-core SuperDome on TPC-H
- 128-core in 1H2011, 256-core ?
- 16-core HP VMs in 1H2011

# Migrating HP Integrity to the Power Express Family

## HP Integrity Server Blades



## IBM Power Express Family

*The highest performing, most energy efficient systems in the industry*



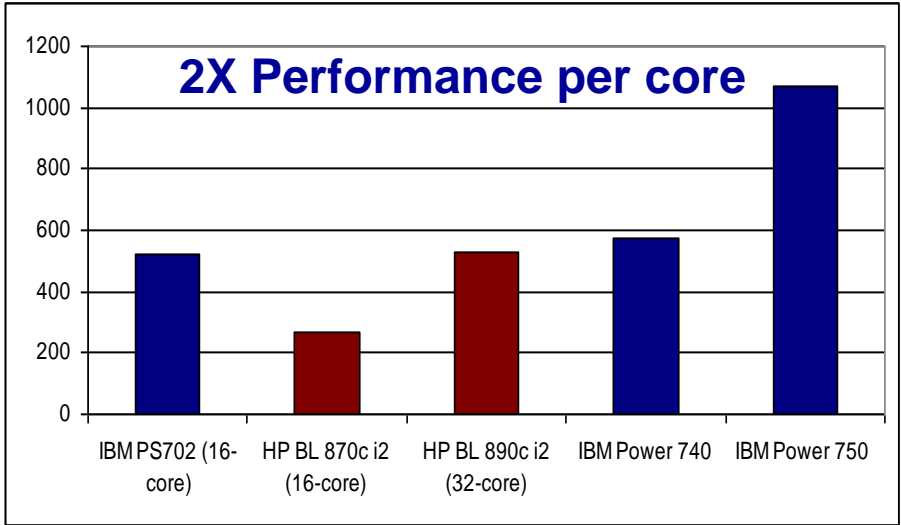
**Power 750**  
*Modular growth through processor card upgrades*



**Power 720/740**  
*Choice of footprint, more performance at lower price*



**Power 710/730**  
*High performance, dense and energy efficient*



Based on SPECint\_rate results as of 7/24/2010.  
Power 740 results based on projections.

[www.spec.org](http://www.spec.org)



## Power Blades

*Blade vs. Blade with similar performance in 1/2 the cores and density.... at a fraction of the price*

# Power 780 versus HP Superdome

## IBM Power 780 delivers significant performance advantage over HP SuperDome

- ✓ *Power 780 delivers over **4.6X** the performance per core based on TPC-C*
- ✓ *Over **3X** the performance per core based on SPECint\_rate*
- ✓ *Over **5X** the performance per core based on SPECjbb2006*

## Intelligent Energy Optimization

- ✓ *Power 780 delivers over **5.8X** the performance per watt based on SPECint\_rate*

## Virtualization without Limits

- ✓ *Power 780 with PowerVM enables partition sizes up to **8X** HP's IVM virtualization software*
- ✓ *Dynamic CPU sharing and support for dedicated I/O*

*After years of development and anticipation, HP's newest Tukwila version of Superdome provides 13.7% performance increase over previous versions based on HP's TPC-H publish*



***IBM Competitive Migration Factory has never been busier!***

## Itanium-based systems are in the news, again

Recent developments in the Itanium market have put HP's customers in a precarious position and created an opportunity for IBM and its partners to capture new opportunity ...

The logo for PCWorld, featuring the word "PCWorld" in white text on a red rectangular background.

December 2009

[Red Hat to Drop Itanium Support](#)



April 2010

[Microsoft Dropping Support for Intel's Itanium chip](#)

The logo for CRN (Computer Reseller News), featuring the letters "CRN" in white on a black and red background.

March 2011

[Oracle's Move To End Itanium Support May Hurt HP](#)

The logo for Oracle, featuring the word "ORACLE" in red, all-caps, sans-serif font.

March 2011

[Oracle Stops All Software Development For Intel Itanium Microprocessor](#)

***“On Oracle dumping Itanium: ... In a report that I wrote last April I said: ‘If I’m running an Oracle database, Oracle infrastructure, or Oracle business applications, I’d be a little concerned about the kind of support and tuning I’d be getting from Oracle on Itanium in the long run.’ It is time to dump Itanium ...”***

-- Joe Clabby, President [Clabby Analytics](#), April 2011



# Leadership Power Systems Portfolio

Select from the broadest system portfolio in the industry

- The highest performance, most scalable UNIX system ever
- Modular footprints enable seamless growth
- The best selection of Entry servers and Blades for UNIX, Linux and IBM i

Power 795



Power 780



Power 770



Power 750



Power 720/740



Power 775



Power 755



Power 710/730



PS Blades



HMC & SDMC



# POWER7 with PowerVM for Virtualization Without Limits



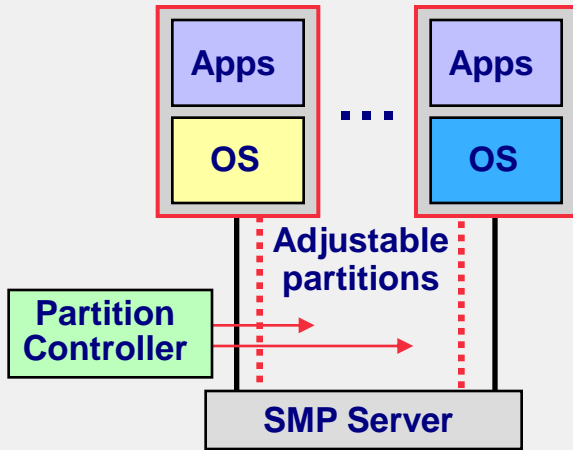
*Higher system utilization means fewer idle resources, lower total power requirements and maximum value obtained from per-CPU licenses!*



- ✓ **Live Partition Mobility** with virtual machines of any size up to the entire system that can easily move between your POWER6 and POWER7 systems
- ✓ **Scales seamlessly from 1/10 of a core to 256 cores** and can use all resources of the host server
- ✓ **Dynamic changes** to any IT resource without reboot
- ✓ **Integrated storage virtualization** for simplified provisioning, management of virtual servers and advanced virtual networking
- ✓ **Secure by design** with zero common vulnerabilities exposures (CVEs) reported against PowerVM by [US CERT](#) or by [MITRE Corporation](#)

# Server Virtualization Approaches

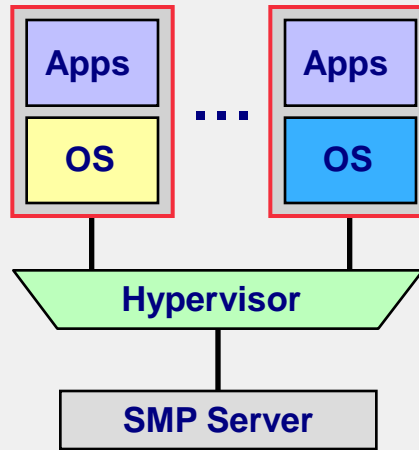
## Hardware Partitioning



Server is subdivided into fractions each of which can run an OS

- Board-level partitioning
  - S/370 SI->PP & PP->SI,
  - Sun Domains, HP nPartitions
- Core/thread-level partitioning
  - Original POWER4 LPAR
  - HP vPartitions
  - Sun Logical Domains

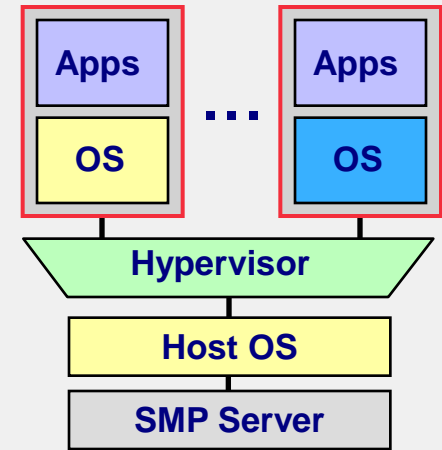
## Bare Metal Hypervisor



Hypervisor provides fine-grained timesharing of all resources

- Hypervisor software/firmware runs directly on server
  - System z PR/SM and z/VM
  - PowerVM hypervisor
  - VMware ESX Server
  - Xen Hypervisor
  - Microsoft Hyper-V

## Hosted Hypervisor



Hypervisor uses OS services to do timesharing of all resources

- Hypervisor software runs on a host operating system
  - VMware GSX
  - Microsoft Virtual Server
  - HP Integrity VM
  - User Mode Linux
  - Linux KVM

## IBM PowerVM vs. Sun Dynamic Domains

*IBM PowerVM Editions offers significant **business advantages** well beyond those offered by Sun's Dynamic Domains simple consolidation play.*

Virtualization capability	IBM PowerVM Editions	Sun Dynamic Domains	Business Value
Linux OS Support	Yes	No <sup>1</sup>	Support for a broader range of applications
Support for Shared Processors	Yes	No <sup>2</sup>	Higher server utilization and consolidation ratios
Partitioning Granularity	1/100 <sup>th</sup> of a CPU, 16 MB or RAM, fraction of an I/O adapter	¼ of a system board (1 processor, 8 DIMMS, and ¼ of I/O attached to the board) <sup>3</sup>	Coarser granularity prevents over allocating resources in a sub-optimal manner to workloads
Live Partition Mobility	Yes	No	Decrease downtime in your enterprise
Support for Shared I/O	Yes	No <sup>2</sup>	Share a resource that is typically underutilized

(1) "Each Domain runs its own copy of the Solaris OS." From p. 3 of "Sun SPARC Enterprise Mx000 Servers Administration Guide", Part No. 819-3601-13, April 2008, Revision A <http://dlc.sun.com/pdf/819-3601-13/819-3601-13.pdf>

(2) "Each instance of the Solaris OS running in a Dynamic Domain has access to its own resources, providing complete isolation of one Solaris instance from any other instance running on the same server." From p. 1 of "Introduction to Dynamic Reconfiguration and Capacity On Demand For Sun SPARC Enterprise Servers", Part No. 820-2084-10, Revision 1.0, 4/22/07, Edition: April 2007, <http://www.sun.com/blueprints/0407/820-2084.pdf>

(3) "Each of the four XSBs contains one-quarter of the total board resources: 1 CPU, 8 DIMMS, and I/O" From p. 49 of "Sun SPARC Enterprise Mx000 Servers Administration Guide" © 2011 IBM Corporation

## IBM PowerVM vs. Sun Logical Domains

IBM PowerVM Editions Offers **Business Advantages** Compared to Sun Logical Domains for Clients Doing Server Consolidation

<i>Virtualization capability</i>	<i>PowerVM Editions</i>	<i>Sun Logical Domains 1.0.3</i>	<i>Business Benefit</i>
Support across entire product line	All POWER5, POWER6 and BladeCenter servers	Sun UltraSPARC T1, T2, and T2 Plus-based servers only <sup>1</sup>	<b>Standardize on one virtualization solution across an entire line of servers</b>
Graphical User Interface	Yes	No <sup>2</sup>	<b>Easily change system configuration without getting carpel tunnel</b>
Dynamic Logical Partitioning	Yes	CPU only (no memory or I/O) <sup>3</sup>	<b>Adapt to changes without downtime</b>
Support for Live Partition Mobility	Yes	No	<b>Decrease downtime in your enterprise</b>
Support for dedicated I/O	Yes	No <sup>4</sup>	<b>Superior performance for I/O intensive workloads</b>

(1) Logical Domains 1.0.3 Release Notes, July 2008 Revision A p2 <http://dlc.sun.com/pdf/820-4895-10/820-4895-10.pdf>; (2) Logical Domains 1.0.3 Administration Guide, May 2008 Revision A p4 <http://dlc.sun.com/pdf/820-4894-10/820-4894-10.pdf> "The Logical Domains Manager provides a command-line interface (CLI) for the system administrator to create and configure logical domains."; (3) Logical Domains 1.0.3 Administration Guide, May 2008 Revision A p6 <http://dlc.sun.com/pdf/820-4894-10/820-4894-10.pdf> "Dynamic reconfiguration (DR) is the ability to add or remove resources while the operating system is running. The Solaris 10 OS supports only the adding and removing of virtual CPUs (vcpus). Dynamic reconfiguration of memory and input/output is not supported in the Solaris 10 OS."; (4) Logical Domains 1.0.3 Administration Guide, May 2008 Revision A p5 <http://dlc.sun.com/pdf/820-4894-10/820-4894-10.pdf>, "This lack of direct physical I/O device access is addressed by implementing a virtualized I/O model."





# POWER7 Leads Exadata in Virtualization with PowerVM

	Feature	PowerVM	EXADATA (X2-8)
Architecture	Hypervisor is core firmware	Yes	No
	Hypervisor is thin layer - not OS based	Yes	No
Scaling, Performance	Max physical server CPUs / memory	256, 16TB	128, 2TB
	Maximum # of VMs per server	1000	0
	VM scalability (CPUs, memory)	256, 16TB	None
	Hypervisor efficiency	High	None
Dynamic Reconfiguration and Optimization	Dynamic VM resources (“DLPAR”)	Yes	None
	Full, dynamic processor sharing	Yes	None
	Full, dynamic memory sharing	Yes	None
	Ability to dedicate all resources	Yes	None
	Ability to specify guaranteed capacity	Yes	None
	Capped & uncapped partitions/groups	Yes	None
	Automatic VM N-way minimization	Yes	None
	Memory compression	Yes	None
RAS (Virtualization Specific)	Hot-node add /cold-node repair / PFA	Yes	Limited
	Concurrent firmware maintenance	Yes	No
	Selective memory mirroring	Yes	No
	VM live mobility	Yes	No
	Redundant virtual I/O server	Yes	No

*Oracle's lack of systems virtualization leads to over provisioning of the physical environment.*

**Do you want to waste resources and pay for what you don't need with Exadata?**

## IBM PowerVM vs. HP nPARs

IBM PowerVM Editions Offers **Business Advantages** Compared to HP nPARs for Clients Doing Server Consolidation

<b>Virtualization capability</b>	<b>PowerVM Editions</b>	<b>HP nPARs</b>	<b>Business Benefit</b>
Dynamic Logical Partitioning	Yes	nPAR Reboot <sup>1</sup>	<b>Adapt to changes without downtime</b>
Support for Shared Processors	Yes	No <sup>2</sup>	<b>Higher server utilization and consolidation ratios</b>
Partitioning Granularity	1/100 <sup>th</sup> of a CPU, 16 MB or RAM, fraction of an I/O adapter	≥1 cell board (4 processor sockets, ≥16 DIMMS, all I/O attached to cell) <sup>3</sup>	<b>Smaller granularity prevents over allocating resources in a sub-optimal manner to workloads</b>
Support for Shared I/O	Yes	No <sup>2</sup>	<b>Share a resource that is typically underutilized</b>
Support for Live Partition Mobility	Yes	No	<b>Decrease downtime in your enterprise</b>

(1) From nPartition Administrator's Guide "You must perform a reboot for reconfig of an active nPartition after you have added a cell to it." and "You must immediately perform a reboot for reconfig of an nPartition when you have removed an active cell from the nPartition." (2) From HP Partitioning Continuum for HP-UX11i on HP 9000 and HP Integrity servers "Because each nPar has its own CPU, memory, and I/O" (3) From nPartition Administrator's Guide, "Either one or two cells. Each cell has up to four processor sockets and up to 16 DIMMs" and "The Superdome 64-way/128-way server is a tightly interconnected dual-cabinet server that has from 4 to 16 cells, each with four processor sockets and up to 32 DIMMs." and "An nPartition includes one or more cells assigned to it (with processors and memory) and all I/O chassis connected to those cells."

## IBM PowerVM vs. HP vPARs

IBM PowerVM Editions Offers **Business Advantages** Compared to HP vPARs for Clients Doing Server Consolidation

<i>Virtualization capability</i>	<i>PowerVM Editions</i>	<i>HP vPARs</i>	<i>Business Benefit</i>
Linux OS Support	Yes	No <sup>1</sup>	<b>Support for open standards</b>
Support for Shared Processors	Yes	No <sup>2</sup>	<b>Higher server utilization and consolidation ratios</b>
Dynamic Logical Partitioning	Yes	Limited <sup>3</sup>	<b>Adapt to changes without downtime</b>
Support for Shared I/O	Yes	No <sup>4</sup>	<b>Share a resource that is typically underutilized</b>
Support for Live Partition Mobility	Yes	No	<b>Decrease downtime in your enterprise</b>

(1) From page 18 of HP-UX Virtual Partitions Administrator's Guide "vPars is a Virtual Partitions product that enables you to run multiple instances of HP-UX simultaneously on one hard partition by dividing that hard partition further into virtual partitions." <http://docs.hp.com/en/T1335-90078/T1335-90078.pdf> Manufacturing Part Number: T1335-90078 September 2007 Edition 13 (2) From page 20 of HP-UX Virtual Partitions Administrator's Guide "A virtual partition uses only the cores and memory that you assign to it; cores are not time-sliced across virtual partitions." <http://docs.hp.com/en/T1335-90078/T1335-90078.pdf> Manufacturing Part Number: T1335-90078 September 2007 Edition 13 (3) From HP-UX Virtual Partitions Administrator's Guide, p. 47, Table 2-4 Dynamic Migration "Dynamic I/O Migration – No" AND "Dynamic CPU Migration – Yes for non-boot processors" AND "Dynamic Memory Migration – Yes for float. For base, can only add base memory (cannot delete online)" <http://docs.hp.com/en/T1335-90078/T1335-90078.pdf> Manufacturing Part Number: T1335-90078 September 2007 Edition 13 (4) From Booting, Installing, Recovery, and Sharing in a vPars Environment from DVD/CDROM/TAPE/Network Version 2.0 11/05/2005 "The concept of "sharing" needs to be clarified for the purposes of this document. Within a vPars environment, I/O, including CD/DVDs and Tape drives, may not be shared internally across vpars. This means that I/O is assigned to one and only one vpar and other vpars cannot see or access it through any internal means, such as the vPars software." [http://docs.hp.com/en/5760/vPars\\_DVD\\_TAPE\\_NET\\_Usage\\_V2.pdf](http://docs.hp.com/en/5760/vPars_DVD_TAPE_NET_Usage_V2.pdf)

# Why is Virtualization and Scalability important?



**\* The #1 reason IT managers deploy virtualization solutions is workload consolidation and software savings**

The more workloads that can be encapsulated within VMs and combined onto a single server, the higher the consolidation ratio, software license reduction and greater **cost reduction and cost avoidance**

The integrated combination of POWER architecture and PowerVM makes possible far higher consolidation ratios than scale-out scenarios

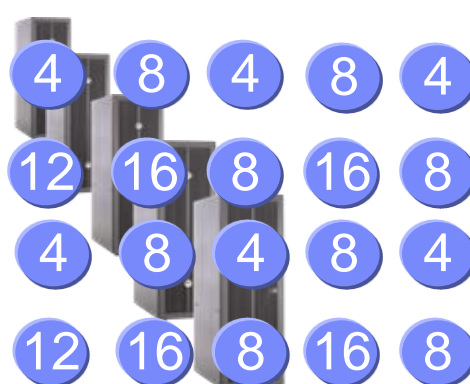
24 WebLogic Servers



9 Oracle RAC Servers



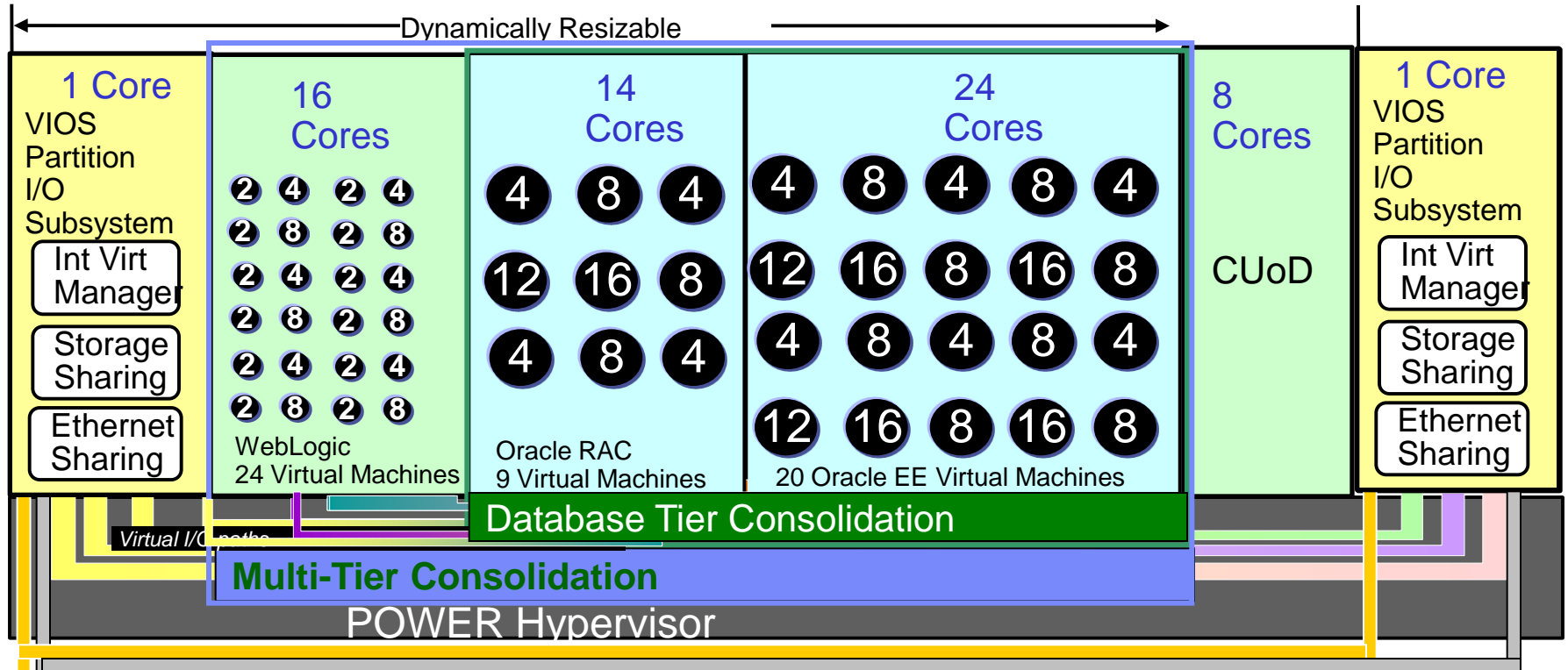
20 Oracle EE Servers



( 8 ) #cores in each physical server

# Power Systems Virtualization

– Proven, Pervasive and Providing Software Efficiency



Oracle Consolidation: ( **8** ) #cores in prior physical server  
 68 Oracle RAC cores consolidated into 14 core Partition  
 176 Oracle EE cores consolidated into 38 core partition  
 37 Oracle RAC licenses put on the shelf  
 108 Oracle EE licenses put on the shelf

Customers are setting up internal resales of software licenses.

**A potential future cost avoidance of \$5.7M or \$2.8M with 50% discount**

# What Migration Risks Concern Customers?

Have no fear:  
It's only migration



Risk	Key Questions
Technical	<p><b>Can it be done?</b></p> <ul style="list-style-type: none"> <li>• Are required ISV products available on the target platform?</li> <li>• What differences need to be addressed such as application APIs, threading and data formats?</li> <li>• Are there tools available to help minimize the complexity and risk?</li> </ul>
Cost	<p><b>Can it be done within the budget?</b></p> <ul style="list-style-type: none"> <li>• How will the migration cost be funded?</li> <li>• Does the business case have a positive ROI?</li> </ul>
Schedule	<p><b>Can it be done on time?</b></p> <ul style="list-style-type: none"> <li>• How much downtime will be required for transition?</li> <li>• When can the business support this change?</li> </ul>
Skills and Culture	<p><b>Are the required resources available?</b></p> <ul style="list-style-type: none"> <li>• How will the existing systems administration and application development team skills be transitioned?</li> <li>• How will retraining be performed?</li> </ul>
Operational	<p><b>How well will it work?</b></p> <ul style="list-style-type: none"> <li>• How will the migrated workload be tested?</li> <li>• Will the performance and reliability meet business requirements?</li> <li>• Will it work the same way on the target platform or will changes in customer, supplier or user interfaces be required?</li> </ul>

Competitive Platforms

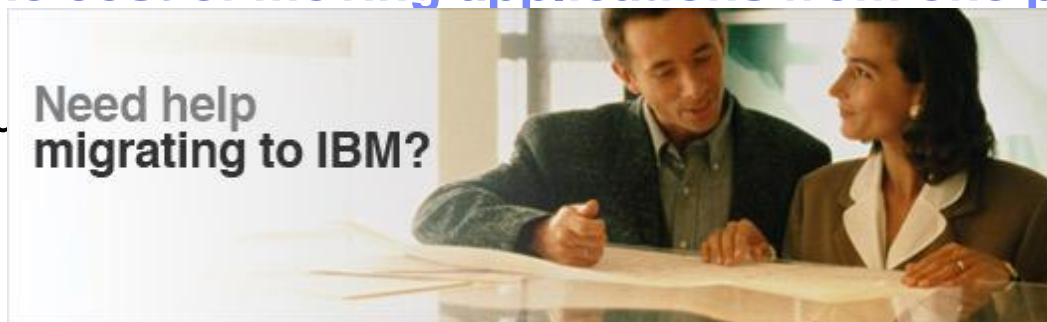
IBM Platforms





## IBM Migration Factory Objectives

- To help minimize the cost of transition/ migration services so they do not become the main objection to moving to IBM
  - Provide and leverage many person-years of application migration knowledge & experience
  - Focus on the use of tools, metrics and automation to reduce the cost of migrating from one platform to another
  - **Mitigate and reduce the risk in moving applications from one platform to another**
  - **Reduce the cost of moving applications from one platform to another**
  - Support successful project management



# Power Systems >40% World wide UNIX Market Share: >50% U.S. Market share

- Power provides cost reduction, cost avoidance and high Business Value
- Total Cost of Ownership and **Business Value** far outweigh Acquisition costs
- Power excels at data centric workloads
- **Utilization rates** are a price/performance **advantage multiplier**
- Power customers have consolidated hundreds of servers to single digits of servers



- **Power7 Consolidating hundreds of Systems**
- **Private Cloud technology for mission critical**

**“The Heist” - Who stole**



**all the Servers?**