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Intel® Xeon® Processor 7500 Series Servers: A Catalyst for Mission-Critical Transformation

Robert Shiveley

Product Manager, Mission Critical Servers, Data Center Group
Intel Corporation

Date: June 23, 2010 - 11:30am

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Agenda

- **Growing Demand for Big Servers**
- **Xeon® 7500 Processor**
- **Scalable Performance**
- **Flexible Virtualization**
- **Advanced Reliability**
- **Catalyst for Mission Critical Transformation**

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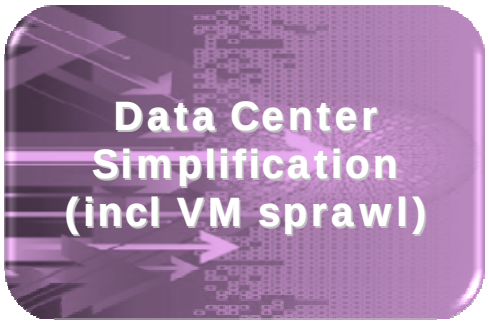
Emerging Server Trends



Market Trends Driving Need for Ever-More Capable Hardware

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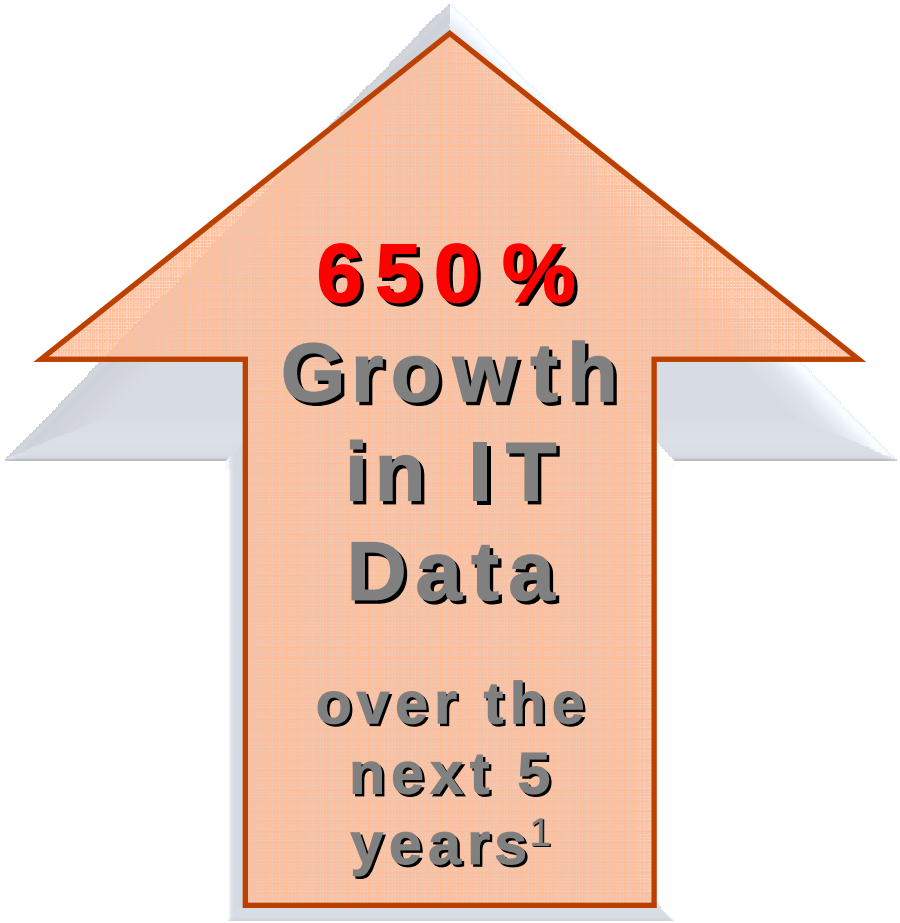
Business Trends Driving Data Center Requirements



- **Data Warehousing / Business Intelligence**
  - More databases
  - Larger databases
  - More users, reports, applications
  - Approaching real-time, continuous analytics
- **BI become integral to operational decision-making**
  - Users need real-time data
  - Increasing pressure to provide timely BI reports

[1] source: Gartner Group 2009: "Hot Trends and Innovations in Data Centers"

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Business Intelligence (analytics) becoming more pervasive, sophisticated and cost-effective for business

"We have reached the point in the improvement of performance and costs that we can afford to perform analytics and simulation for each and every action taken in the business."

Gartner

"[Today] organizations are capturing ever-more relevant data, structured and unstructured, to inform their business decisions. And at their disposal are more sophisticated software tools (and cheaper underlying processing power) to identify patterns and make correlations in that data with greater accuracy"

InformationWeek

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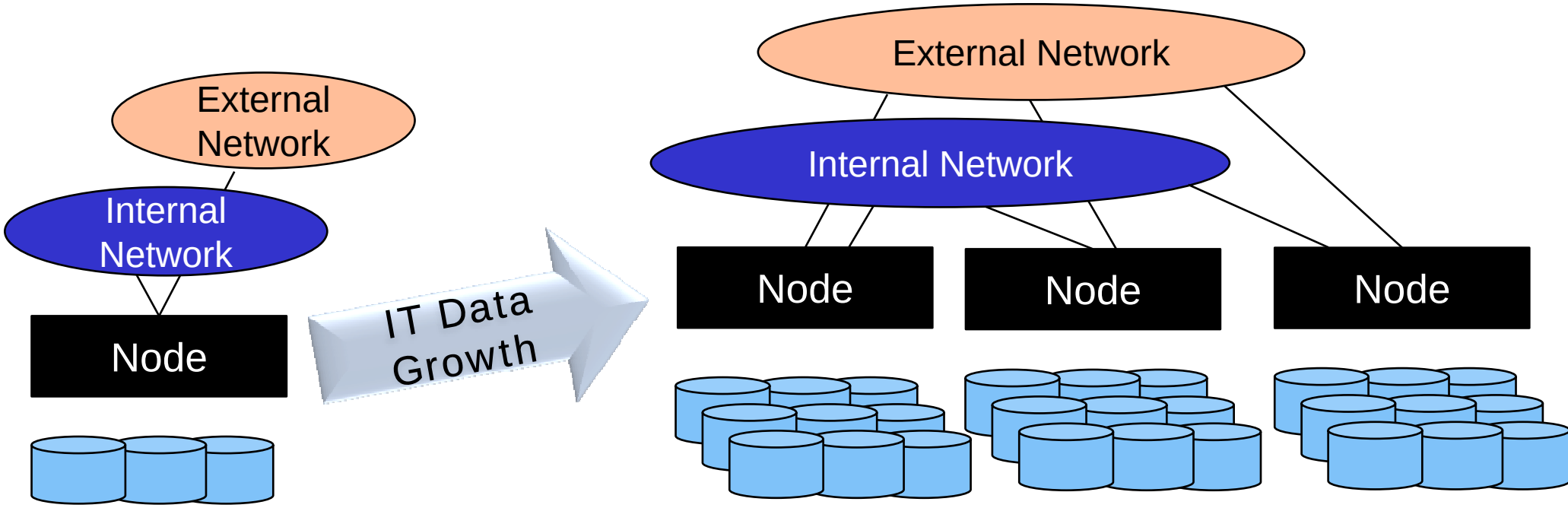
Delivering on SLAs As Information Requirements Grow



- BI/DW has evolved from off-line, batch processing to 24x7 real-time, all-the-time
- Data growth impacts more than storage…
- Performance requires keeping up with growth in: cache, memory, I/O, thread support
- High availability reaquires advanced RAS across all platform components (HW+SW)

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Growing Demand for Big Servers

Cloud Computing

26% CAGR '09-13[1]

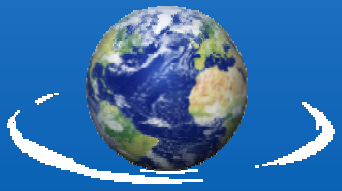
Data Growth & Information Demand

650% Data Growth[2]

Real Time Business Intelligence

$6.8B Market by 2013[3]

High Performance Computing



$11.1B Market by 2013, Supercomputers $3.8B[4]

1 IDC eXchange, Worldwide IT Spending On Cloud Services, Cloud Computing 2010 An IDC Update, (http://blogs.idc.com/ie/?p=543) October 2009
2 Gartner Group "Hot Trends and Innovations in Data Centers" over next 5 years, 2009
3 IDC Multiclient Study Worldwide Server Workloads, June 2009
4 IDC Economic Crisis Response: Wordwide Technical Computing Server 2009-2013 Forecast Update, November 2009, Doc # 220541

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Today's High-End Computing Challenges
Current Usages and Trends Drive Hardware

- Bigger Workloads
- Higher & Bigger VM Densities
- Accelerating Platform and Datacenter Modernization
- High Performance Computing Super Nodes
- Ongoing ROI and TCO Focus

Mission Critical Workloads require:

- Application Performance
- Scalability
- High Availability
- Best Performance / $ at Capacity

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Agenda

- Growing Demand for Big Servers
- **Xeon® 7500 Processor**
- Scalable Performance
- Flexible Virtualization
- Advanced Reliability
- Catalyst for Mission Critical Transformation

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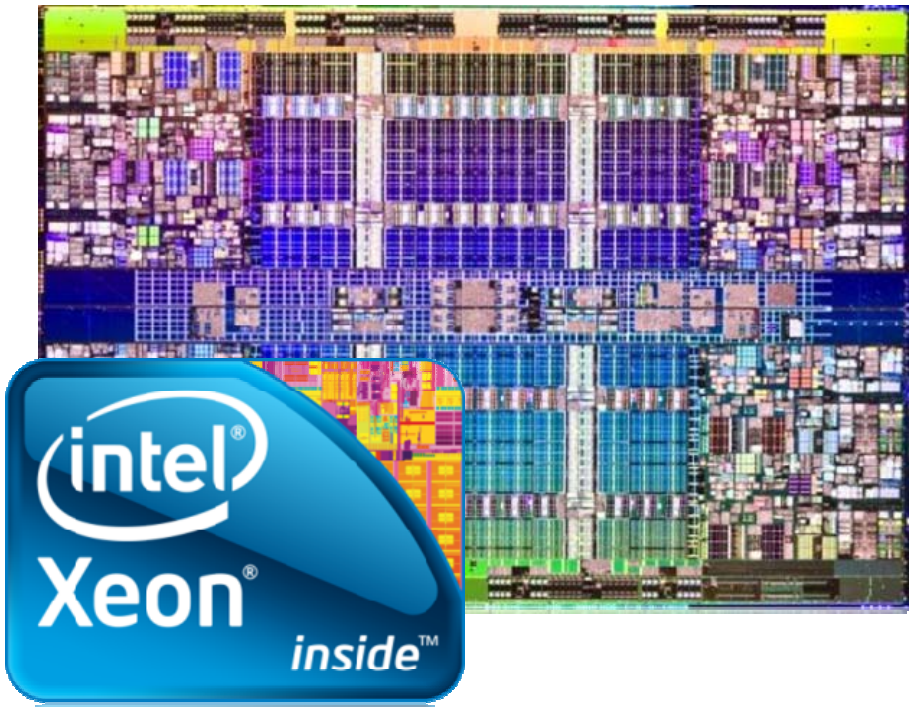
Introducing the Intel® Xeon® 7500 Series Processor

Based on the Next Generation Intel® Microarchitecture



A New Generation of Intelligent Servers

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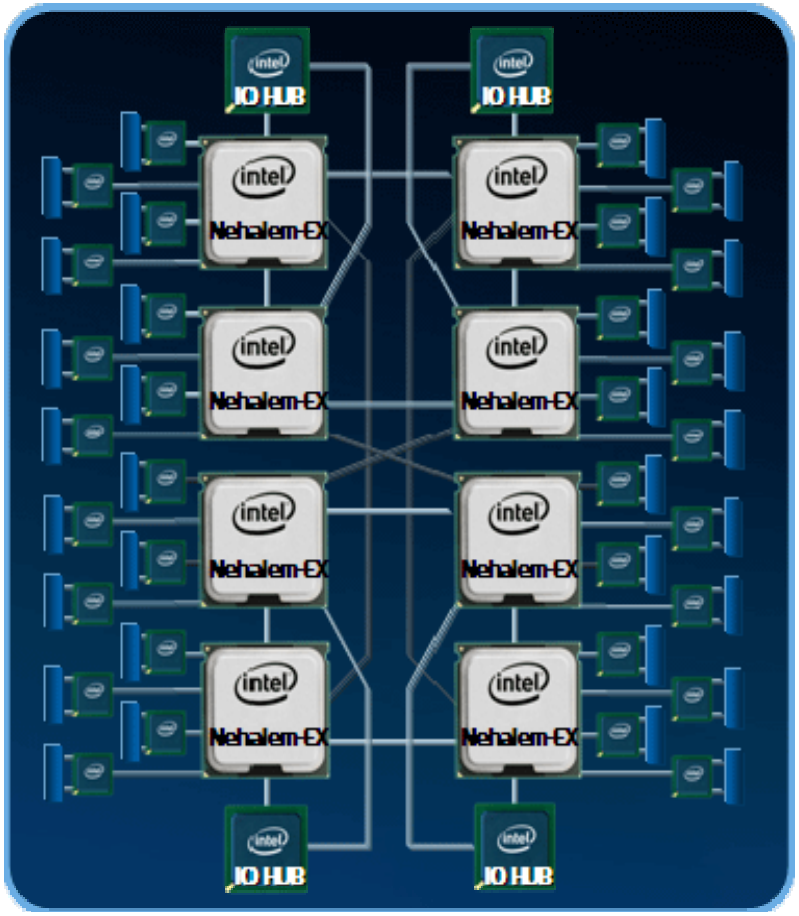
Intel® Xeon® 7500 Series: Capable of handling the biggest workloads

Intel Xeon 7500 8-Socket System



Mission Critical Workload Categories

- **Medium to Large Database**
  - Database consolidation
  - Large monolithic databases
- **Large In-Memory Applications**
  - Business analytics (BI), point-of-purchase, real-time authorizations
- **Virtualization of larger workloads**
  - ERP, CRM, LOB applications
- **Higher levels of server consolidation**
  - Increasing VM density levels
- **End-to-End Solutions-In-A-Box**
  - Emerging model

Xeon 7500-based systems support Mission Critical workloads

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Intel® Xeon® Processor 7500 Performance Records[1]

#1 World Record
64S SPECint*_rate_base2006
10,400 score

#1 x86 Record
64S SPECfp*_rate_base2006
6,840 score

#1 World Record
8S TPC Benchmark* E
3,141 tpsE @ $768.92/tpsE (8P/64C/128T)[2]

#1 8-Socket Record
8S SAP* SD 2-Tier (Unicode)
16,000 Benchmark Users

#1 Two-Tier Record
4S SAP BI Datamart
854,649 query navigation steps

#1 8-Socket Record
8S SPECjbb*2005
3,321,826 BOPS @ 103,807 BOPS/JVM

#1 4-Socket Record
4S TPC Benchmark* E
2,022 tpsE @ $493.92/tpsE (4P/32C/64T)[3]

#1 4-Socket Windows* Record
4S SAP* SD 2 Tier (Unicode)
10,450 Benchmark Users

#1 single-node World Record
4S SPECjAppServer*2004
11,057 JOPS@Standard

#1 single-node Record±
4S LS-Dyna* Crash Simulation
41,727 seconds car2car

#1 World Record
4S VMmark* v1.1
71.85 score @ 49 tiles

#1 4-Socket x86 Record
4S SPECint*_rate_base2006
723 score

#1 2-Socket x86 Record
2S SPECint*_rate_base2006
362 score

#1 2-Socket Record
2S SPECjbb*2005
1,011,147 BOPS @ 126,393 BOPS/JVM

Over 20 New x86 Server World Records!

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[1]World record claim based on comparison of like socket server platforms based on x86 architecture unless otherwise stated. Performance results based on published/submitted results as of March 29, 2010. See http://www.intel.com/performance/server/xeon_mp/summary.htm for details.

2. NEC: Availability is June 24,2010.
3. IBM x3850 X5 server is planned to be generally available March 31, 2010. The total solution availability for the TPC-E benchmark is July 30, 2010.

±Submitted or published Topcrunch.org

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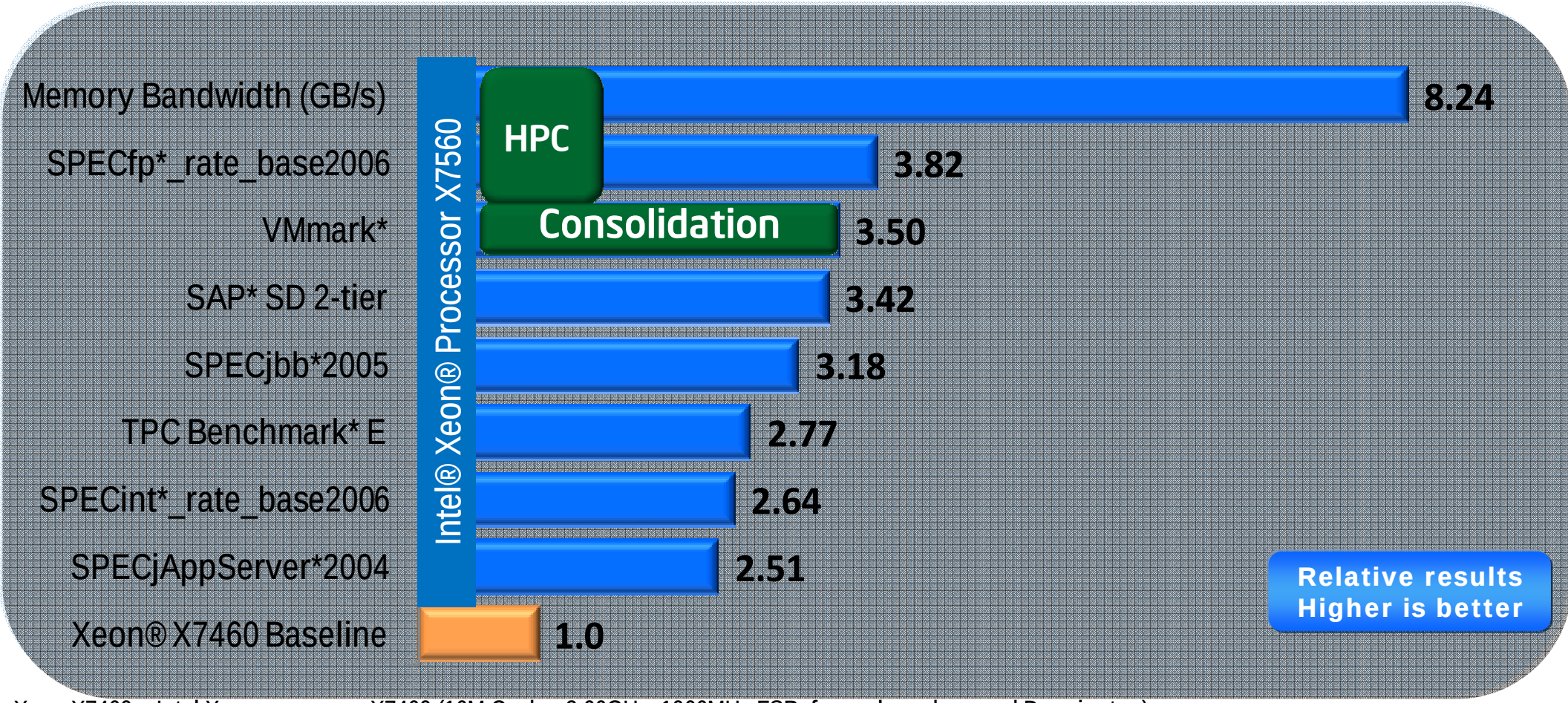
Intel® Xeon® Processor 7500 series-based Serve

4S Standard Benchmarks Performance Summary



Xeon X7460 = Intel Xeon processor X7460 (16M Cache, 2.66GHz, 1066MHz FSB, formerly codenamed Dunnington)
Xeon X7560 = Intel Xeon processor X7560 (24M Cache, 2.26GHz, 6.40GT/s Intel® QPI, formerly codenamed Nehalem-EX)

Average of 3x performance improvement over 7400 series across a range of benchmarks

Source: Best published / submitted results comparison of best 4-socket Xeon X7460 and X7560 models as of March 26, 2010.
See previous "Broad Performance Claim" foil and notes for more information.

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- Scalable Performance
- **Flexible Virtualization**
- Advanced Reliability
- Catalyst for Mission Critical Transformation

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Intel® Xeon® 7500 Series optimizes virtualization through processor, chipset, and I/O Enhancements

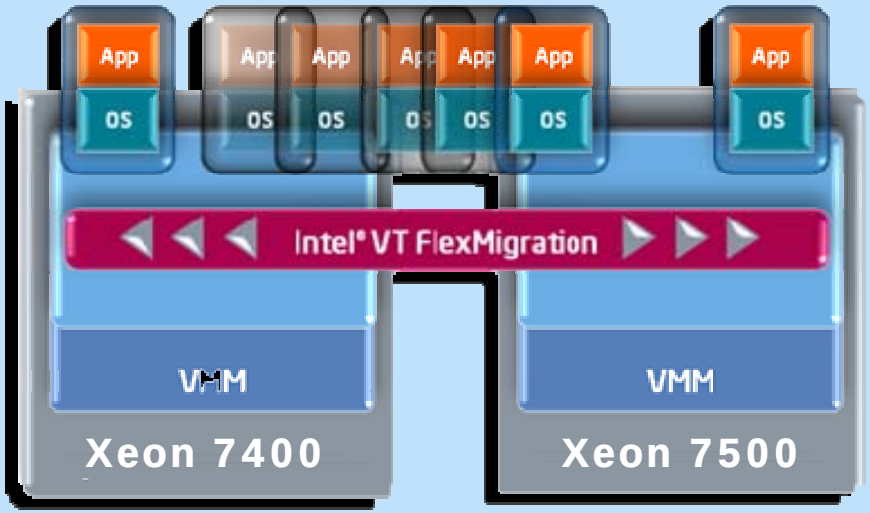
Consolidation

More Resources, Hardware Assist

CapEx and OpEx Reduction Improved Utilization

Live Migration

Enhanced I/O, Compatible Architecture



Fluid Movement of VMs Over Network

Virtualization Enables Investment Protection, Versatility and Flexibility

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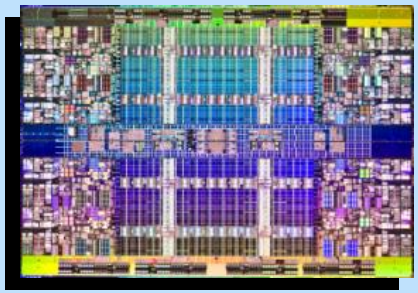
Xeon® 7500: Meeting the Highest Virtualization Needs



Xeon® 7500

- 8C/16 threads per socket
- 2-256 socket scaling
- 256GB memory per skt
- 2X I/O capacity
- Mission Critical RAS

Intel Platform Virtualization Technologies

Intel® VT-x	Intel® VT For Directed I/O	Intel® VT For Connectivity
Processor	Chipset	Network

Intel® VT Flex Migration

- Large Scale, Mission Critical Virtualization (>8GB)
- Infrastructure Consolidation (of multi-tier Applications)
- Headroom for Peak & Unpredictable Demand
- Live Migration of Big Workloads

Optimized for the most demanding virtualization workloads

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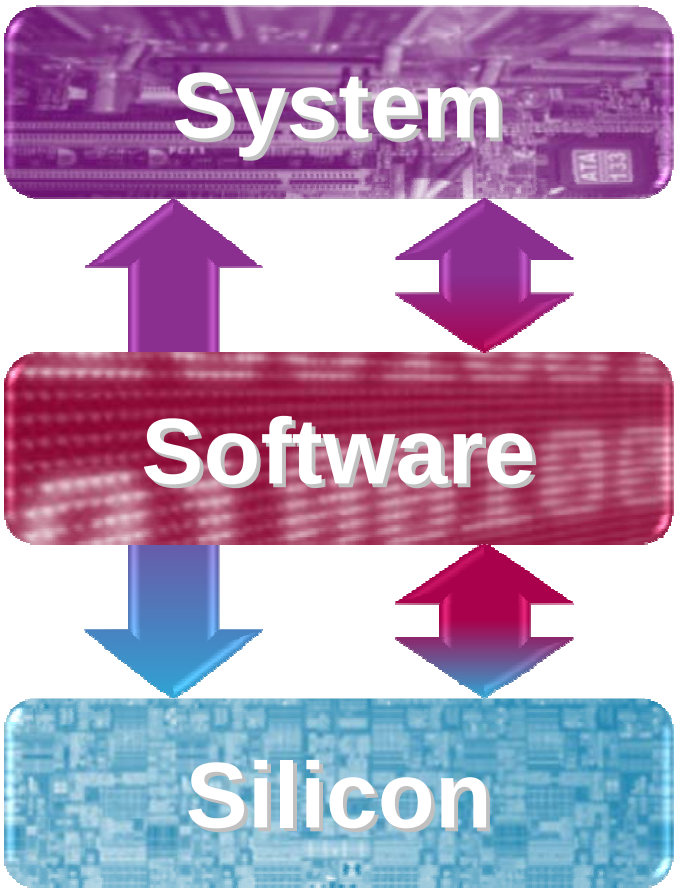
Advanced Reliability Starts With Silicon; and Requires An Ecosystem



Sophisticated Workload Management & Tools

Mission Critical OS

solaris
suse
redhat
Windows Server 2008 R2

OEM Innovation

IBM sgi hp
Bull NEC
HITACHI inspur
UNISYS FUJITSU
ORACLE CISCO DELL
CRAY THE SUPERCOMPUTER COMPANY

Optimized for Next Generation Database & Apps

Intel Xeon 7500 Series-based Solutions Span Silicon, OS, System

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Advanced Reliability Starts With Silicon

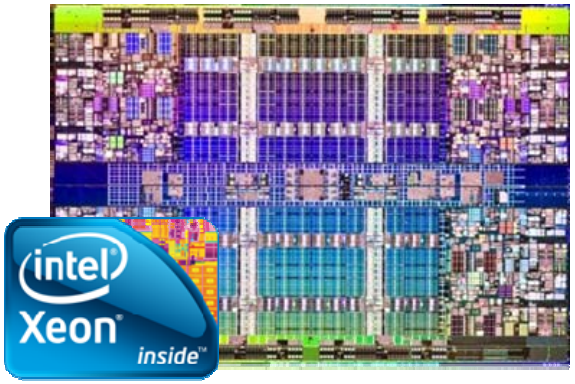
Xeon® Processor 7500 Series Reliability Features

Memory

- **Inter-socket Memory Mirroring**
- **Intel® Scalable Memory Interconnect (Intel® SMI) Lane Failover**
- **Intel® SMI Clock Fail Over**
- **Intel® SMI Packet Retry**
- Memory Address Parity
- Failed DIMM Isolation
- **Memory Board Hot Add/Remove**
- **Dynamic Memory Migration***
- **OS Memory On-lining ***
- **Recovery from Single DRAM Device Failure (SDDC) plus random bit error**
- Memory Thermal Throttling
- Demand and Patrol scrubbing
- Fail Over from Single DRAM Device Failure (SDDC)
- **Memory** DIMM **and Rank Sparing**
- Intra-socket Memory Mirroring
- **Mirrored Memory Board Hot Add/Remove**

I/O Hub

- **Physical IOH Hot Add**
- **OS IOH On-lining***
- PCI-E Hot Plug



CPU/Socket

- **Machine Check Architecture (MCA) recovery**
- **Corrected Machine Check Interrupt (CMCI)**
- **Corrupt Data Containment Mode**
- **Viral Mode**
- **OS Assisted Processor Socket Migration***
- **OS CPU on-lining ***
- **CPU Board Hot Add at QPI**
- **Electronically Isolated (Static) Partitioning**
- **Single Core Disable for Fault Resilient Boot**

Intel® QuickPath Interconnect

- **Intel QPI Packet Retry**
- **Intel QPI Protocol Protection via CRC (8bit or 16bit rolling)**
- **QPI Clock Fail Over**
- **QPI Self-Healing**

Over 20 New RAS features across the entire platform

Intel Whitepaper: Advanced Reliability for Intel® Xeon® Processor-based Servers: The Intel® Xeon® Processor 7500 Series: http://www.intel.com/Assets/en_US/PDF/whitepaper/323479.pdf

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Bold text denoted new feature for Xeon® 7500
* Feature requires OS support, check with your OS vendor for support plans
Some features require OEM server implementation and validation and may not be provided in all server platforms.

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Advanced RAS Delivers Value For IT

Protects Your Data	Reduces circuit-level errors	• Parity Checking And ECC • Memory Thermal Throttling • Memory Demand & Patrol Scrubbing • Corrupt Data Containment Mode • Viral Mode • Intel QPI Protocol Protection *Via CRC (8bit Or 16bit Rolling)*
	Detects data errors across the system	
	Limits the impact of errors	
Increases Availability	Heals failing data connections	• MCA Recovery With OS Support • Intel® SMI Lane Failover • Intel® SMI Clock Fail Over • Intel® SMI & QPI Packet Retry • QPI Clock Fail Over • QPI Self-healing • SDDC Plus Random Bit Error Recovery • Memory Mirroring • Memory DIMM And Rank Sparing • Dynamic CPU And Memory Migration
	Supports redundancy and failover for key system components	
	Recovers from uncorrected data errors	
Minimizes Planned Downtime	Helps predict failures before they happen	• Electronically Isolated (Static) Partitioning • MCA Error Logging (CMCI) With OS Predictive Failure Analysis • Memory Board Hot Add/Remove • OS Memory On-lining* • CPU Board Hot Add At QPI • OS CPU On-lining
	Maintain partitions instead of systems	
	Proactively replace failing components	

Support for Highly Available System Deployments

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Delivering System Reliability, Availability, & Serviceability

Detect And Correct Errors Where Possible

Recover From Uncorrectable Errors

Prevent Future Errors

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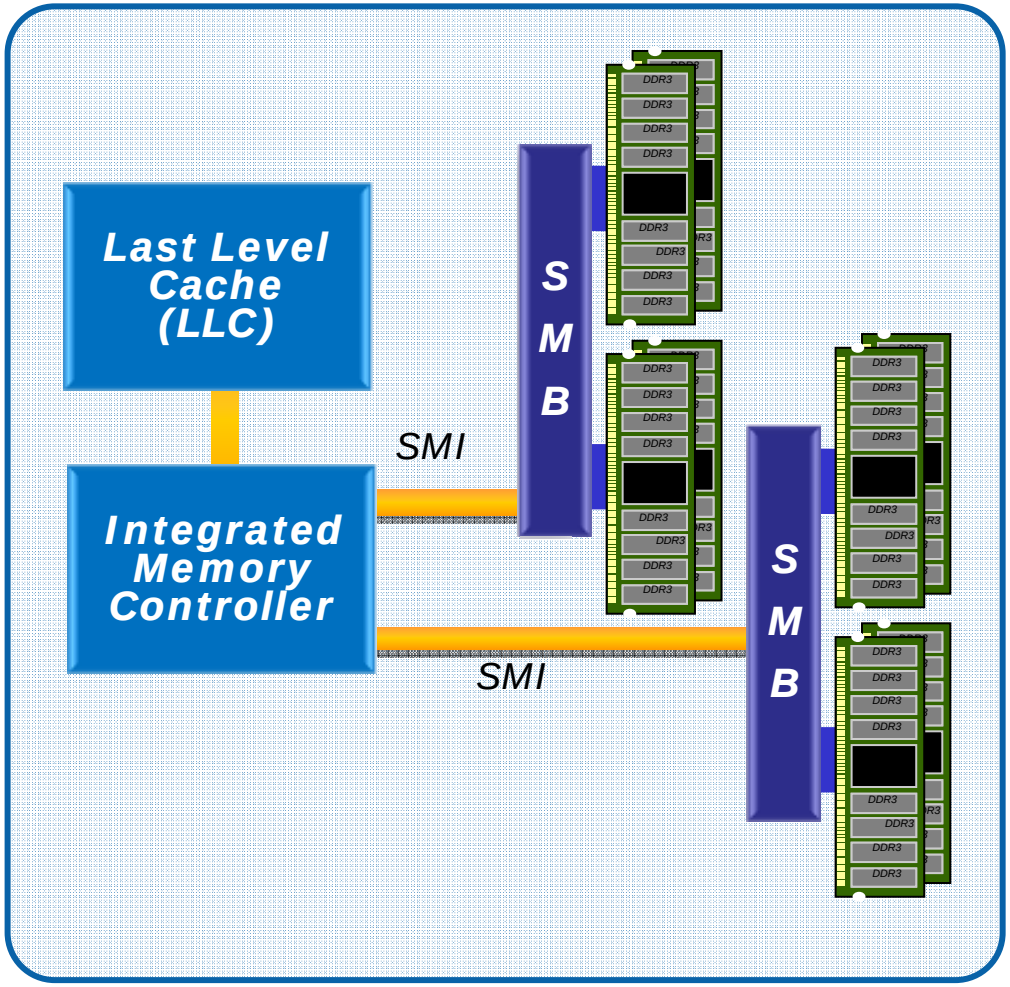
Scalable Memory Subsystem Error Detection & Correction



Demand and Patrol Scrubbing:

- ✓ *Proactively searches for memory errors*
- ✓ *If an error is detected, data is written back corrected or contained if uncorrectable*

Explicit Write-Back:

- ✓ *Proactively checks for errors as data is written from last level cache*
- ✓ *If an error is detected, data is written back corrected or contained if uncorrectable*

Single DRAM Device Data Correction Plus 1 Bit:

- ✓ *Failover from single DRAM device error*
- ✓ *Single bit error correction continues after DRAM failover*

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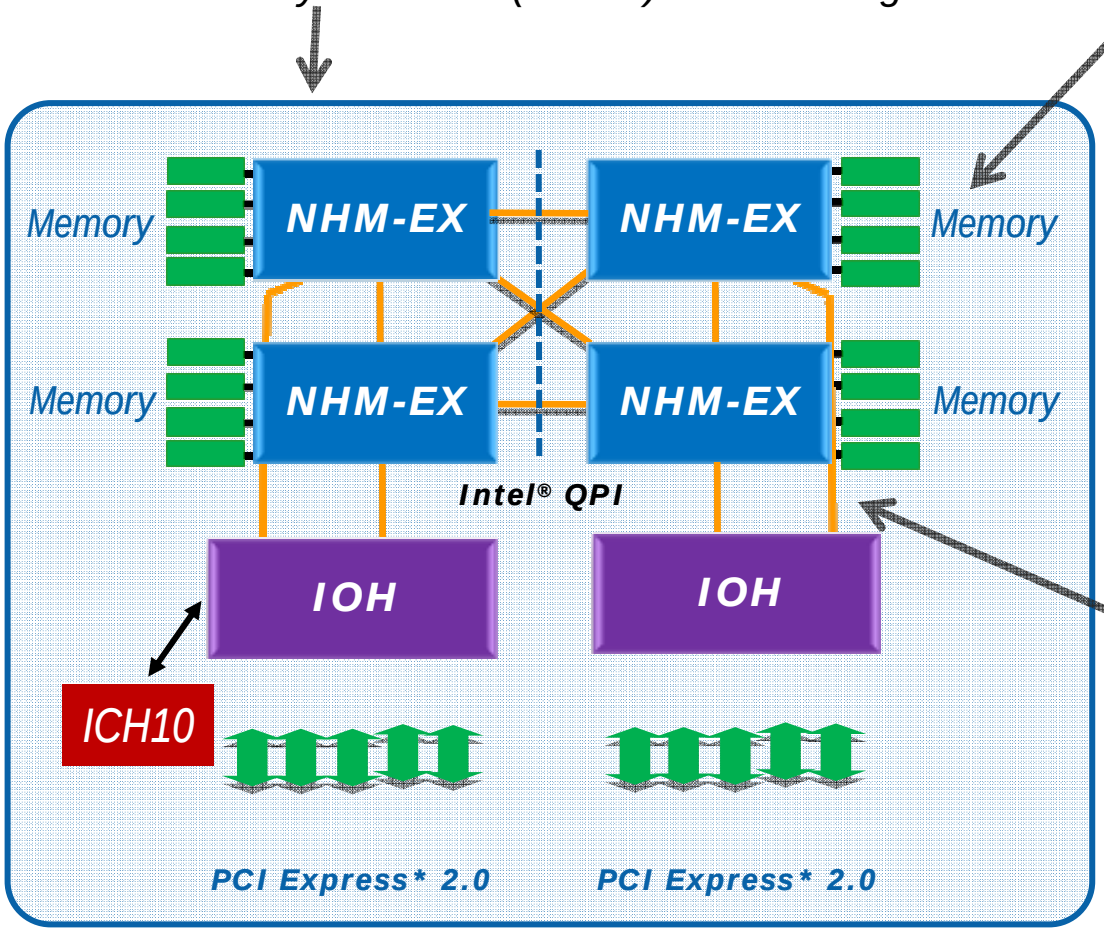
Built-In Redundancy & Failover Throughout

Socket Redundancy & Failover

- *Dynamic OS Assisted Processor Socket Migration**
- *Electronically Isolated (Static) Partitioning*



Memory Redundancy & Failover

- *Inter-socket Memory Mirroring*
- *Intra-socket Memory Mirroring*
- *Intel® SMI Lane Failover*
- *Intel® SMI Clock Fail Over*
- *Intel® SMI Packet Retry*
- *Memory DIMM and Rank Sparing*
- *Dynamic Memory Migration*
- *Fail Over from Single DRAM Device Failure (SDDC)*
- *Recovery from Single DRAM Device Failure (SDDC) plus random bit error*

Intel® QPI Redundancy & Failover

- *QPI Self-Healing*
- *QPI Clock Fail Over*
- *Intel QPI Packet Retry*

Intel® QPI = Intel® QuickPath Interconnect
Intel® SMI = Intel® Scalable Memory Interconnect

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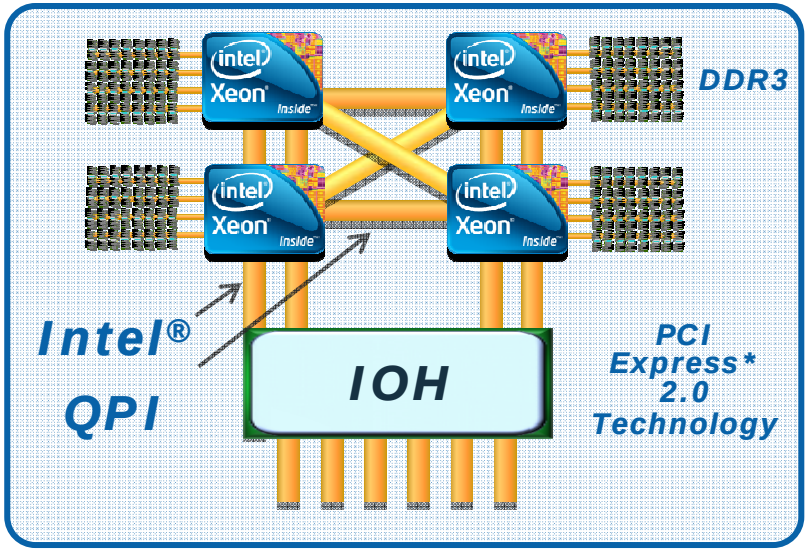
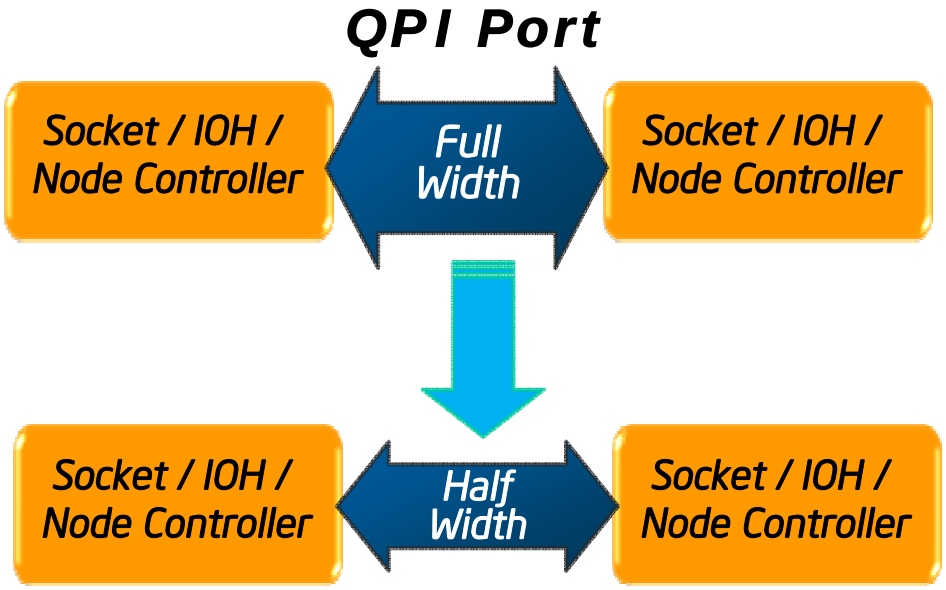
Intel® QuickPath Interconnect (QPI) Self-Healing

- Intel® QPI Self-Healing maintains system availability in the event of persistent interconnect errors
- On detecting persistent errors the QPI port automatically reduces to half the current width and keeps operating at a reduced level
- The system administrator sets the threshold at which to go into self-healing mode





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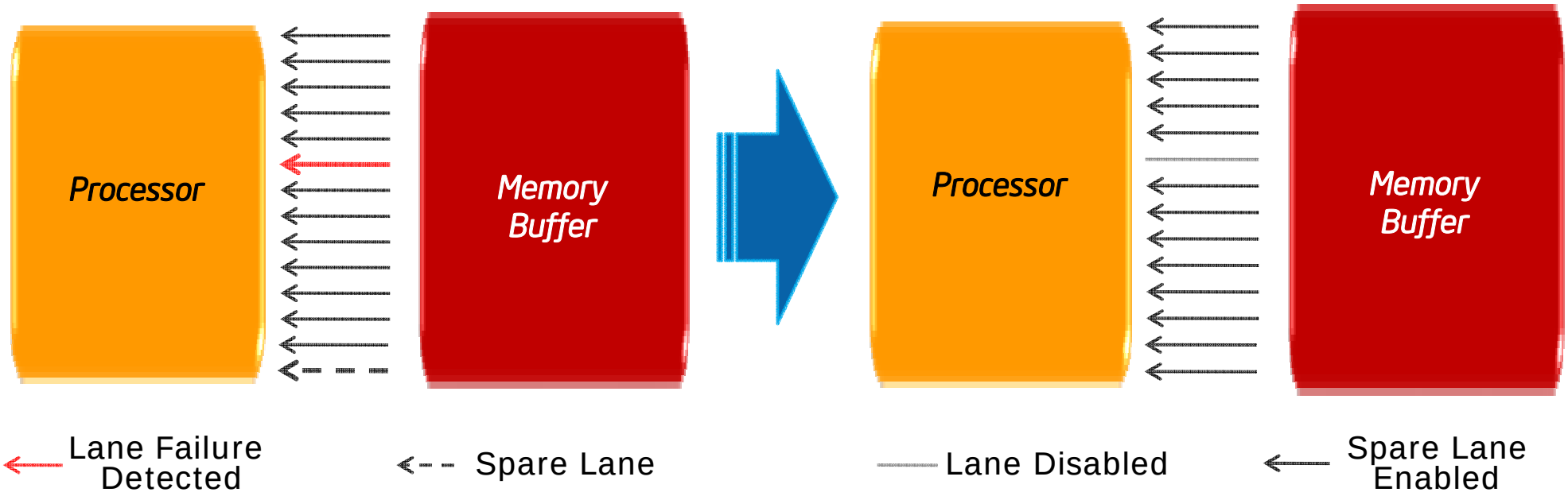
Intel® Scalable Memory Interconnect (SMI) Lane Failover

Memory Read Example



- Intel® SMI allows the memory interconnect to automatically failover and recover from partial link failures maintaining availability and performance
- Intel® SMI provides an additional interconnect lane in each direction (memory write & read)
- If a single lane failure is detected, the failed lane is automatically mapped out by the CPU and the spare lane is enabled

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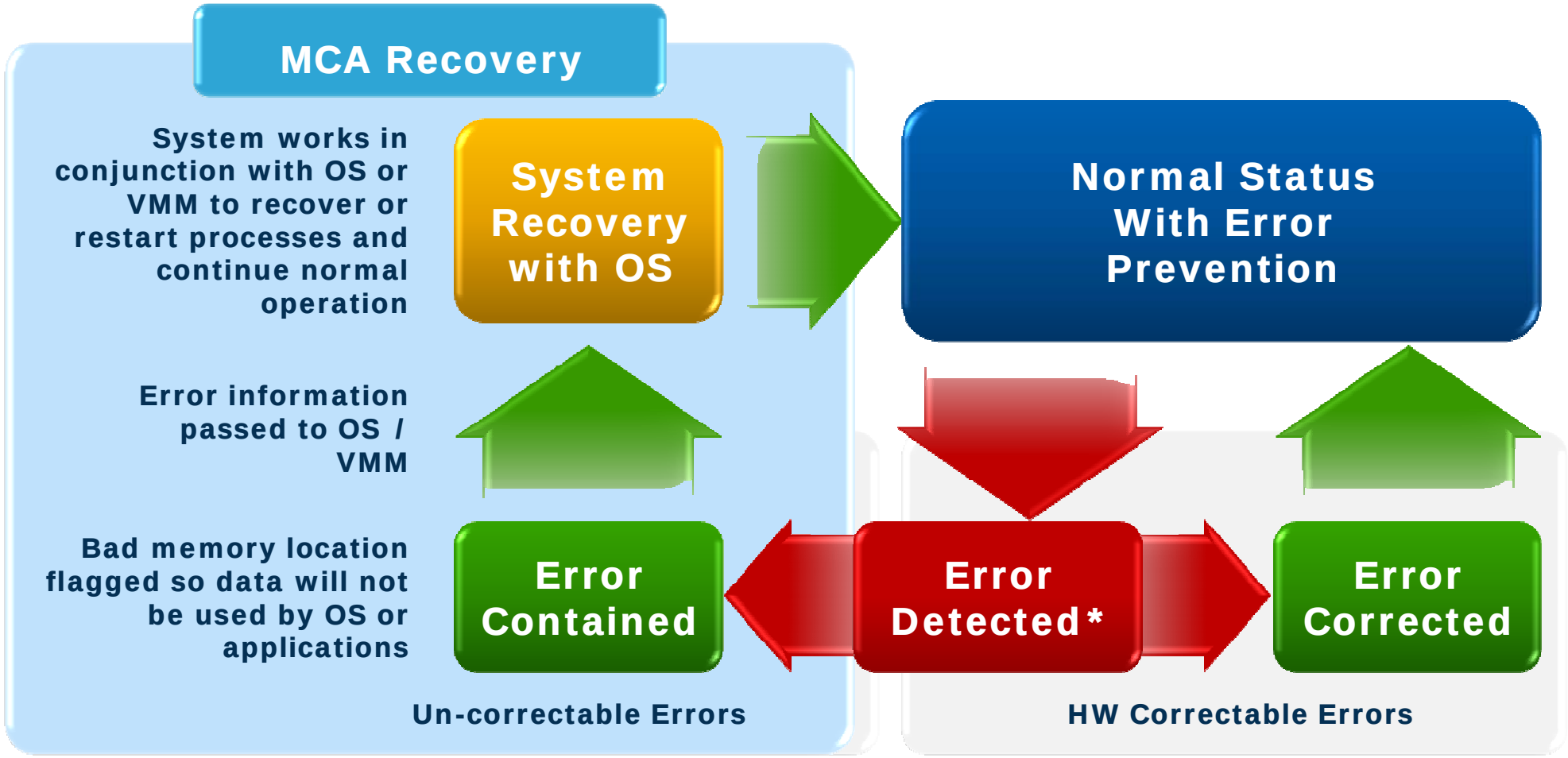
Machine Check Architecture Recovery

First Machine Check Recovery in Xeon®-based Systems
Previously seen only in RISC, mainframe, and Itanium-based systems



Allows Recovery From Otherwise Fatal System Errors

*Errors detected using Patrol Scrub or Explicit Write-back from cache

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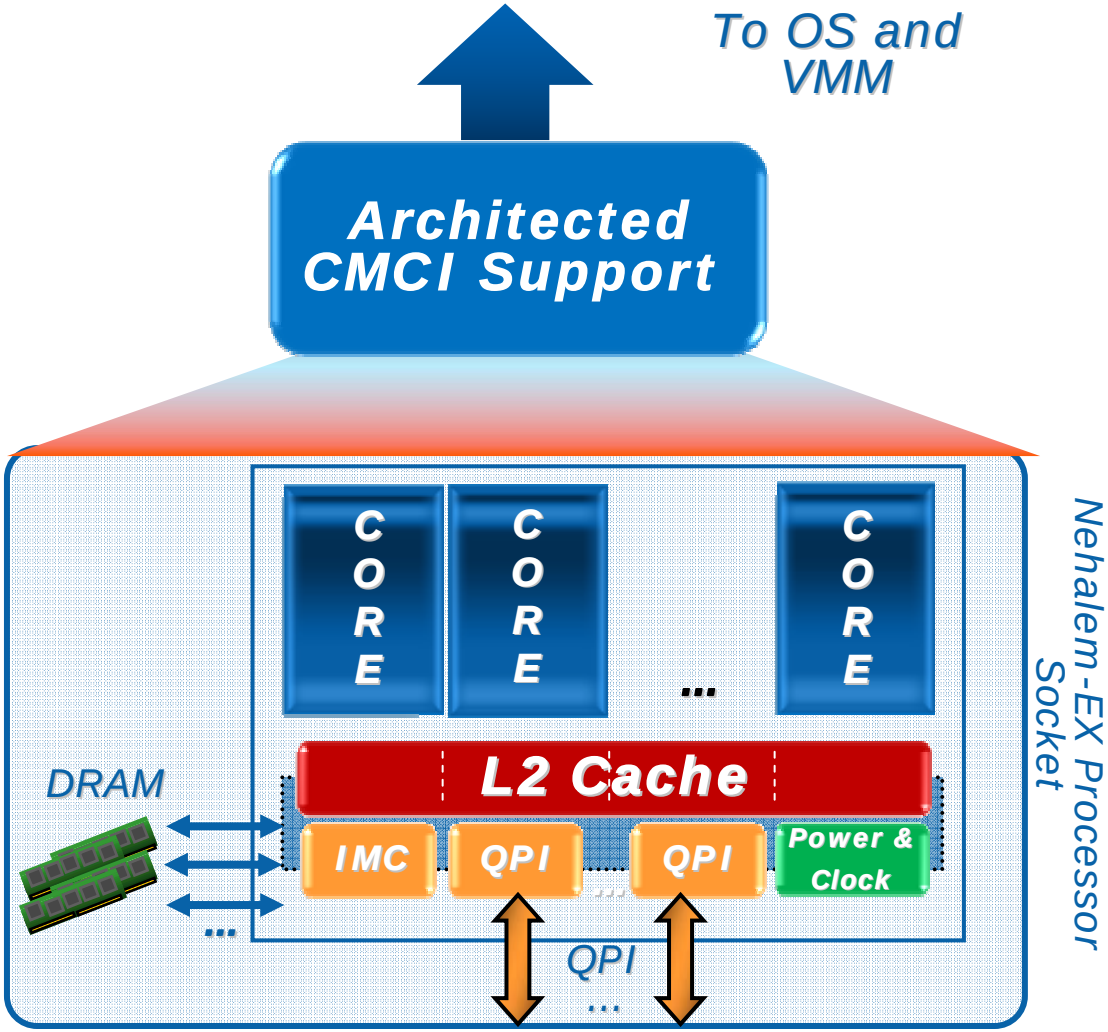
Hardware Corrected Errors & Predictive Failure Analysis

- Most hardware errors are detected and corrected internally without any interruption in availability
  - e.g. parity checking and error correcting code
- Corrected Machine Check Interrupt (CMCI) signals the OS with information about corrected errors
- The tools in the OS perform Predictive Failure Analysis to isolate failing components for replacement



Helps to Identify Failing Components Before They Fail

Intel® QPI = Intel® QuickPath Interconnect *Nehalem = Intel® microarchitecture, codenamed Nehalem*

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Software Community & System vendors Align around Large Mission Critical Solutions *(8 sockets)*

2007

2010

OEMs with Scalable, Mission Critical Xeon® Server Designs

OS and VMM Vendors Integrating Support for Advanced RAS Features

Microsoft®

ORACLE®

Novell

redhat

vmware®

Delivering an Integrated Solution For Highly Available Deployments

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Xeon® 7500: A Catalyst for Mission Critical Transformation

"Red Hat Enterprise Linux has a well-deserved reputation for reliability, availability, serviceability, scalability and performance and is designed to take advantage of these new capabilities. ***We believe the combination of Red Hat and Intel are a game-changer for Mission-Critical computing."***

redhat

Paul Cormier, Exec VP & President, Products and Technologies

"This is huge. ***This is Intel taking its x86 architecture up into the mainframe space."***

-Robert Enderle, Senior Analyst, The Enderle Group

"The new levels of reliability and performance delivered by the Intel Xeon processor 7500 series are impressive. *We expect customers to benefit when used together with innovative SAP enterprise solutions."*

SAP

Vishal Sikka, Member of The Executive Board of SAP AG

"Both the Xeon 7500 and its associated ecosystem are today ***fully capable of running a wide range of workloads that were historically more associated with mainframes or RISC/Unix systems."***

-Gordon Haff, Principle IT Advisor, Illuminata, Inc.

"Nehalem EX's core platform attributes make it ***very capable to further disrupt parts of a declining RISC market."***

IDC Analyze the Future

-Vernon Turner, Senior Vice President IDC

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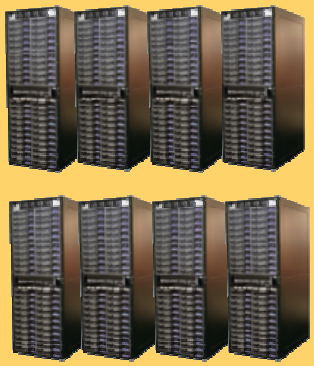
Sun* UltraSPARC IV+* Refresh: 2010

8-socket Sun Fire V890 → 8-socket Xeon® 7500*

2007 Sun

Sun 8-Socket UltraSPARC IV+* Servers



8 racks Sun Fire V890 servers

2010 Intel

Efficiency Refresh 8:1

1 rack of Intel® Xeon® 7500 Based Servers

89 % Annual Energy Cost Reduction (estimated)

As Low as 27 Month Payback

– OR –

Performance Refresh 1:1

8 racks of Intel® Xeon® 7500 Based Servers

Up to 8x Performance Improvement

13 % Annual Energy Costs Estimated Reduction (estimated)

Source: Intel measurements as of May 2010. Performance comparison using server SPECint_rate_base2006. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. For detailed calculations, configurations and assumptions refer to the legal information slide in backup.

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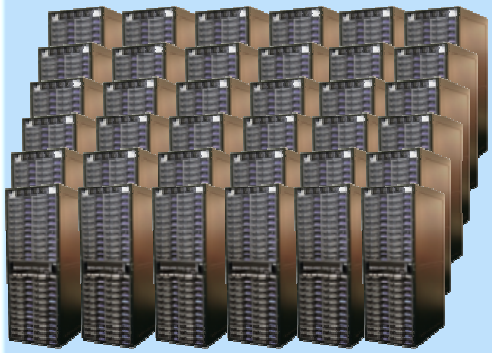
Server Refresh & Consolidate

Single Core 4-socket → Xeon® 7500 8-socket

2005



36 Racks of Intel® Xeon® Single Core, 4-socket Servers

2010

Efficiency Refresh 36:1

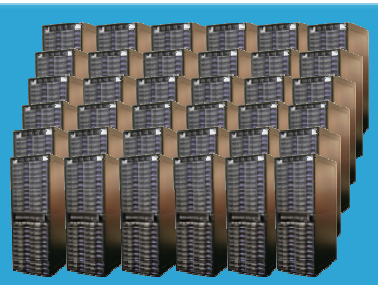
1 Rack of Intel® Xeon® 7500 Based Servers

Up to 91% Annual Energy Costs Reduction ***(Estimated)***

As Little as 14 months Payback ***(Estimated)***

– OR –

Performance Refresh 1:1



36 Racks of Intel® Xeon® 7500 Based 8-socket Servers

Up to 36x Performance ***(Estimated)***

Source: Intel measurements as of March 2010 of Xeon 7500 and single-core 4-socket systems. Performance comparison using SPECint_rate_base2006. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. For detailed calculations, configurations and assumptions refer to the legal information slide in backup.

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CASE STUDY—Migration in Action: Odyssey Logistics and Technology

"Red Hat Enterprise Linux running on Intel Xeon processors is truly a rock-solid platform. We absolutely trust Red Hat and Intel with our most mission-critical systems."

– Brad Massey, IT Director, Odyssey Logistics and Technology

- Exponential business growth; **83 percent compounded growth rate in IT transactions**
- Logistics applications are directly integrated with the supply chain operations & **ensuring high levels of performance, scalability, and availability critical**
- Needed to upgrade IT infrastructure, but **concerned about the cost of upgrading existing UNIX/RISC infrastructure**.
- **Moved mission-critical batch services to virtualized Intel Xeon processor-based servers running Red Hat Enterprise Linux.**
- Initial migration so painless and the savings so immediate that **OL&T decided to completely eliminate UNIX from its environment and is now transitioning to Red Hat Enterprise Linux on Intel processor-based servers across its entire infrastructure.**
- Read the complete case study at: http://rhcustomers.files.wordpress.com/2009/08/rh_odysseylogistics.pdf

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CASE STUDY—Migration in Action: Wall Street Systems

"Our clients are completely comfortable knowing that they can run their largest, most critical systems on Red Hat® Enterprise Linux® and that they'll get enterprise-class support."
– Mark Tirschwell, Chief Technology Officer, Wall Street Systems

- Global provider of mission-critical financial applications; **needs applications to deliver high-end performance, scalability, availability, and value.**
- **Migrated all flagship products from UNIX/RISC to Red Hat Enterprise Linux running on Intel Xeon processor-based servers**
- New platform **reduces capital costs for a typical customer implementation from around USD 1 million to about USD 250,000 (75% reduction in costs)**
- **Headroom to grow:** New platform used to support software as a service (SaaS) offerings and its internal development and quality assurance activities.
- Transition enabled the company to **consolidate 15 server racks down to 12 racks using built-in Red Hat Enterprise Linux virtualization**
- Read the complete case study at: www.redhat.com/f/pdf/customers/RH_CS_WallStreetSystems_web.pdf

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CASE STUDY—Migration in Action: YPF SA

"Our systems are more operationally efficient, and we still have the high performance our business demands, coupled with decreased costs."
– Adriana Marisa Vazquez, UNIX administration group, YPF

- Argentina's largest oil and gas company
- **Began moving critical business applications from multiple proprietary UNIX/RISC architectures to Red Hat Enterprise Linux on Intel Xeon processor-based servers as far back as 1999.**
- Impact on cost and performance immediate and positive; now runs more than **80 percent of its Oracle databases and 90 percent of its SAP applications on the new Red Hat/Intel platform.**
- Relies on Red Hat Network to simplify administration and Red Hat virtualization to **greatly simplify new deployments, eliminate server sprawl, and enable maintenance without downtime through live VM migration.**
- Read the complete case study at: www.redhat.com/f/pdf/customers/RH_CS_YPF.pdf

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CASE STUDY—Migration in Action: Sabre Holdings, Travelocity

> *"Compared to proprietary UNIX/RISC solutions, our testing has shown that Red Hat Enterprise Linux on Intel performs three times faster and at a fraction of previous costs."*
>
> *– Robert Wiseman, Chief Technology Officer at Sabre Holdings*

- Sabre Holdings operates the **largest travel distribution service in the world**
- Solutions must withstand **extremely high sustainable volumes; peaking at 32,000 transactions per second, available 24x7, with five-nines uptime**.
- Need to capitalize on business growth opportunities while **containing infrastructure costs and meeting those rigorous requirements**
- **Has successfully migrated numerous mission-critical applications from its previous UNIX/RISC architecture to Red Hat Enterprise Linux running on Intel processor-based servers; new corporate standard.**
- Currently exploring virtualization and cloud computing opportunities as a way to further improve the quality and cost effectiveness of its IT solutions.
- Read the complete case study at: www.redhat.com/f/pdf/blog/RH_SabreHoldings_CS_734891_0808_cw_web.pdf

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Linux on Intel Xeon 7500 Series can result in dramatic cost savings

76 percent lower TCO over three years; total savings of $4.4 million(1)

	Solution running on Intel® Xeon® Processor 7500 Series-based Servers	Solution running on Oracle SPARC* T5440 Servers	Savings with Red Hat Enterprise Linux® and Intel® Processor-based Servers	
Cost per Server Including 3-year support costs	USD 40,890	USD 163,265	USD 122,375 (per server)	75%
Energy Consumption per Server Based on typical workloads	804 Watts	1,766 Watts	962 Watts (per server)	54%
Number of Servers Required Based on SPECjbb*2005 results	10	22	12 fewer servers	54%
Total Acquisition Costs Including hardware, software, training, planning, migration, and 3-year support costs	USD 784,617	USD 4,377,258	USD 3,592,641	82%
3-Year Operating Costs Including software support, power, cooling, and data center and server administration costs	USD 586,740	USD 1,399,200	USD 812,460	58%
3-Year Total Cost of Ownership	**USD 1,371,357**	**USD 5,776,458**	**USD 4,405,101**	**76%**

(1) Download the full TCO study at: www.principledtechnologies.com/clients/reports/Dell/R910_TCO.pdf

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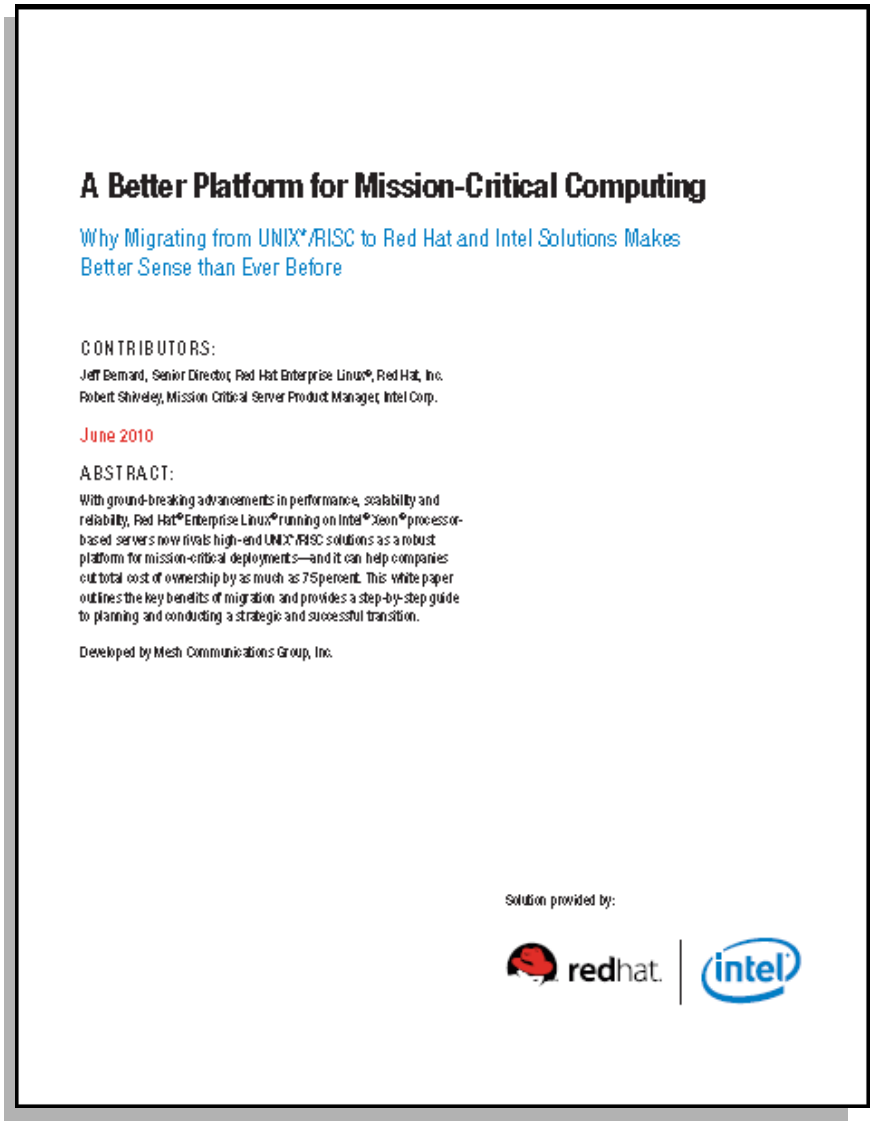
RISC to Red Hat Enterprise Linux on Intel Xeon 7500 Series *Migration Guide*

Migration Best Practices:

1. Understand your business goals
2. Define your deployment strategy
3. Create your strategic migration plan
    1. Infrastructure application analysis & standard build
    2. Functional applications analysis and high level cost estimate
    3. Readiness and risk analysis
    4. Strategic migration roadmap
    5. Implementation



A Better Platform for Mission-Critical Computing

Why Migrating from UNIX*/RISC to Red Hat and Intel Solutions Makes Better Sense than Ever Before

CONTRIBUTORS:

Jeff Bernard, Senior Director, Red Hat Enterprise Linux®, Red Hat, Inc.
Robert Shiveley, Mission Critical Server Product Manager, Intel Corp.

June 2010

ABSTRACT:

With ground-breaking advancements in performance, scalability and reliability, Red Hat® Enterprise Linux® running on Intel® Xeon® processor-based servers now rivals high-end UNIX*/RISC solutions as a robust platform for mission-critical deployments—and it can help companies cut total cost of ownership by as much as 75 percent. This white paper outlines the key benefits of migration and provides a step-by-step guide to planning and conducting a strategic and successful transition.

Developed by Mesh Communications Group, Inc.

Solution provided by:

redhat. | intel

Download the Migration Guide here: http://www.xxx

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Intel® Xeon® 7500—OEM System Innovation

2-socket Expandable

RACKS

BLADES

4-Socket Blades

8-sockets or Greater

First Ever! **75% Increase[1]** **5X[1]**

Greater Choice Way Beyond 4-socket Racks

SUMMIT JBOSS WORLD

PRESENTED BY RED HAT

[1] Source: Industry data on Intel® Xeon® Processor 7400 Series based designs shipping today and Intel data on Xeon 7500 designs expected to ship beginning today and in the future. Not all OEM system designs shown. * Other names and brands may be claimed as the property of others

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Intel® Xeon® 7500 Processor Series

A Transformational Server Processor

Transforming
Enterprise

- Biggest performance leap in Xeon history[1]
- 20:1 consolidation of older, single-core 4S servers[2]
- Est. 12 months ROI payback via lower operating costs[2]
- Flexible design broadens MP category well beyond 4S

Transforming
Mission Critical

- Over 20 new RAS features including MCA-recovery[3]
- Scalability from 2 to 256 sockets
- As low as 1/5th the cost of RISC-based systems[4]

Transforming Enterprise and Mission Critical workloads

2. Estimate of Xeon 7500 vs older single core 4socket servers. See 20:1 Refresh Foil for details
3. See RAS list for new features
4. Estimate of 4S Xeon 7500 vs 4S POWER7 system public pricing. See "4S Price/Performance vs RISC" slide for details
5. 8X per Intel internal memory BW measurement 3.2.10
6. 8 socket system with 128 DIMM slots populated with 16GB DDR3 DIMMs

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Relative performance is calculated by assigning a baseline value of 1.0 to one benchmark result, and then dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms, and assigning them a relative performance number that correlates with the performance improvements reported.

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Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

Hyper-Threading Technology requires a computer system with a processor supporting HT Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information including details on which processors support HT Technology, see here

“Intel® Turbo Boost Technology requires a Platform with a processor with Intel Turbo Boost Technology capability. Intel Turbo Boost Technology performance varies depending on hardware, software and overall system configuration. Check with your platform manufacturer on whether your system delivers Intel Turbo Boost Technology. For more information, see http://www.intel.com/technology/turboboost.”

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor series, not across different processor sequences. See http://www.intel.com/products/processor_number for details.

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BACKUP

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Sun* UltraSPARC IV+* Refresh: 2010 ROI Claim – Back up

15 month ROI claim estimated based on comparison between 2S Dual Core Intel® Xeon® 5160 (3.0GHz) and 2S Intel® Xeon® X5680 based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, $0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of $900/year per server, per server cost of $7200 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured server side java benchmark results (Intel Corporation Feb 2010). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 5x.

Baseline platform: Intel server platform with two Dual-core Intel® Xeon® Processor 5160, 3.33GHz, 1333MHz FSB, 8x2GB FBDMIMM DDR2-667 memory, 1 hard drive, 1 power supply, Microsoft* Windows* Server 2003 Ent. SP1, Oracle* JRockit* build P27.4.0-windows-x86_64 run with 2 JVM instances

New platform: Intel server platform with two Intel® Xeon® Processor X5680 (12M Cache, 3.33 GHz, 6.40 GT/s Intel® QPI), 24 GB memory (6x4GB DDR3-1333), 1 SATA 10krpm 150GB hard drive, 1 800w power supply, Microsoft Windows Server 2008 64 bit SP2, Oracle* JRockit* build P28.0.0-29 run with 4 JVM instances

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit Intel Performance Benchmark Limitations.

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Sun* UltraSPARC IV+* Refresh: 2010 Calculation Details

	2007	2010	Delta / Notes
Product	UltraSPARC IV+ (2.10GHz)	Intel® Xeon® X7560 (2.93GHz)	
Performance per Server	1	**Up to 10x increase**	Intel internal measurements on a server SPECint_rate_base2006 benchmark as of March 2010
Server Power Idle / Active Power	1452.9W idle / 2906W active	1360W idle / 2424W active	Server idle for 16 hours per day and active for 8 hours per day
# Servers needed	80	10	8:1 server consolidation
# Racks needed	8 racks	1 rack	**8:1 Rack Consolidation**
Annual kWhr	1,531,473	166,193	**Estimated 80% lower energy costs**
Annual Energy Costs	$306,294.57	$33,238.66	$273,055.91 electricity cost reduction per year. Assumes $0.10/kWhr and 2x cooling factor
OS Licensing Costs	$72,000	$9,000	$63,000 less per year Assumes a RHEL 1yr license at $900
Estimated Annual Cost Savings of $336,055.91			
Cost of new HW	n/a	$750,000	Assume $75,000 per server
Estimated 27 Month Payback			

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Server Refresh & Consolidate ROI Claim – Back up

15 month ROI claim estimated based on comparison between 2S Dual Core Intel® Xeon® 5160 (3.0GHz) and 2S Intel® Xeon® X5680 based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, $0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of $900/year per server, per server cost of $7200 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured server side java benchmark results (Intel Corporation Feb 2010). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 5x.

Baseline platform: Intel server platform with two Dual-core Intel® Xeon® Processor 5160, 3.33GHz, 1333MHz FSB, 8x2GB FBDMIMM DDR2-667 memory, 1 hard drive, 1 power supply, Microsoft* Windows* Server 2003 Ent. SP1, Oracle* JRockit* build P27.4.0-windows-x86_64 run with 2 JVM instances

New platform: Intel server platform with two Intel® Xeon® Processor X5680 (12M Cache, 3.33 GHz, 6.40 GT/s Intel® QPI), 24 GB memory (6x4GB DDR3-1333), 1 SATA 10krpm 150GB hard drive, 1 800w power supply, Microsoft Windows Server 2008 64 bit SP2, Oracle* JRockit* build P28.0.0-29 run with 4 JVM instances

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Server Refresh & Consolidate Calculation Details

	2005	2010	Delta / Notes
Product	(Intel® Xeon® MP CPU 3.3Ghz (Single core w/ HT, 1MB L2, 8MB L3)	Intel® Xeon® X7560 (2.93GHz)	
Performance per Server	1	**Up to 36x increase**	Intel internal measurements on a server SPECint_rate_base2006 benchmark as of March 2010
Server Power Idle / Active Power	480W idle / 780W active	1360W idle / 2424W active	Server idle for 16 hours per day and active for 8 hours per day
# Servers needed	360	10	36:1 server consolidation
# Racks needed	36 racks	1 rack	**36:1 Rack Consolidation**
Annual kWhr	1,992,211	166,193	**Estimated 91% lower energy costs**
Annual Energy Costs	$398,442.24	$33,238.66	$365,203.58 electricity cost reduction per year. Assumes $0.10/kWhr and 2x cooling factor
OS Licensing Costs	$324,000	$9,000	$315,000 less per year Assumes a RHEL 1yr license at $900
Estimated Annual Cost Savings of $680,203.58			
Cost of new HW	n/a	$750,000	Assume $75,000 per server
Estimated 14 Month Payback			

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