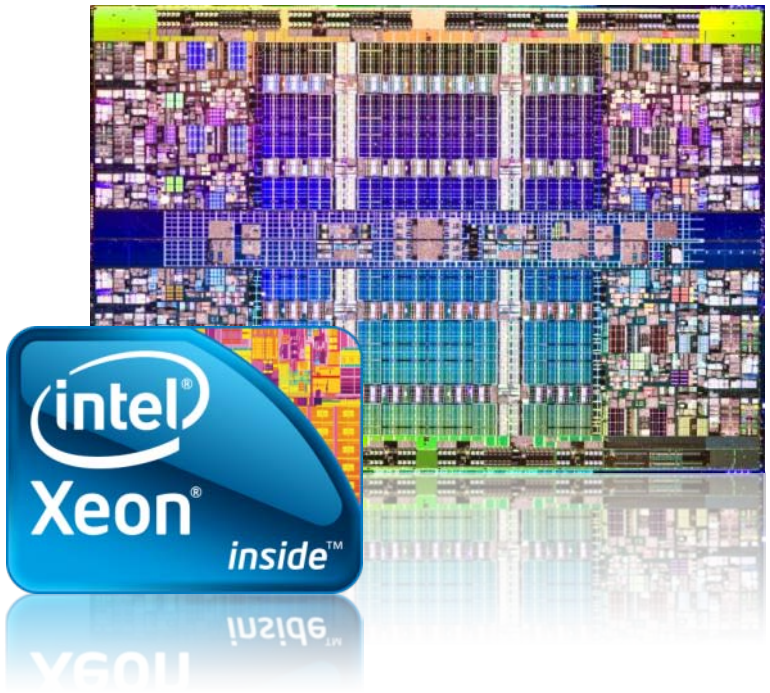

Intel® Xeon® Processor 7500/6500 Series

Public Gold Presentation

Matt Kmiecik
Data Center Group

This slide MUST be used with any slides removed from this presentation

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- 64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.
- Lead-free: 45nm product is manufactured on a lead-free process. Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package.
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Presentation Notes

Title: Intel® Xeon® Processor 7500/6500 Series Public GOLD Presentation

Version: 1.1

Owner: Matt Kmiecik, DCG Marketing

Shelf Life: September 30, 2010 or until replaced

Target Audience: End Users (IT), OEM Sales

Approved use:

All this material is **Public**

Slides with **RED BARS** are not intended for use with End Users

Revision History:

Rev 1.0	Public version	3/30/10
Rev 1.1	Misc changes primarily to compress file size	4/1/10

Presentation Objectives

For notes and disclaimers, see performance and legal information slides at end of this presentation.

- PUBLIC presentation on the upcoming Intel® Xeon® Processor 7500 series
  - Key messages and features for Intel® Xeon® Processor 7500 /6500series platforms

- Intel® Xeon® Processor 7500 series key messages:
  - A Transformative processor.
    - Continues IT transformation that began with Nehalem/5500 launch last year-- but with even bigger impact in the big-server market
  - Transforming Enterprise:
    - Biggest perf. leap in Xeon history--3X on broad range of benchmarks
    - Up to 20:1 consolidation of older, single-core 4S servers
    - Estimated 12 month server ROI payback via lower operating costs
    - Variety of systems and socket options → greatly expand choice beyond 4-sockets
  - Transforming Mission Critical:
    - Over 20 new RAS features including MCA-recovery
    - Increased scalability from 2 to 256 sockets
    - As low as 1/5th the cost of RISC-based systems
  - Transforming High Performance Computing
    - 8X memory bandwidth of prior generation
    - 2 terabytes shared mem. capacity *(with 8 sockets; even higher with 3rd party chips)*
    - Super node scaling for largest data intensive problems

For More Information on the Intel® Xeon® Processor 7500/6500 Series

- Please use the link below for the Xeon® 7500 Sales Tool catalog, which contains descriptions and links to the vast majority of publicly-available presentations, briefs, animation, and videos:
  Intel® Xeon™ Processor 7500 Series--Consolidated Sales Tools

- Other Content:
  - Xeon 7500/6500 OEM systems summary
  - Xeon 7500 performance summary
  - Xeon 7500 RAS overview for end users
  - Xeon 7500 Memory Performance and Configuration Guide
  - Xeon and Itanium joint positioning in Mission Critical
  - Xeon 7500 Software Marketing Guide
  - Xeon 7500 HPC competitive guide
  - Intel Xeon ROI Tool

30 Second

Intel® Xeon® Processor 7500 Series

The Greatest Intel® Xeon® Performance Leap In History!

Average 3X Performance
on a range of benchmarks
vs. Intel® Xeon® 7400 Series†

New levels of scalability and advanced reliability for your Mission Critical applications

The Right Investment – Right Now
***up to* 20:1 consolidation refresh of Single Core Servers**
12 Month Estimated Payback

† Average of 3x performance claim based on geometric mean of four industry-standard, common enterprise benchmarks (SPECjbb*2005, SPECint*_rate_base2006, SPECfp*_rate_base2006, and TPC Benchmark* E) comparing best published / submitted results on 4-socket (4S) Intel Xeon processor X7560 –based server platform to best published 4S Intel Xeon processor X7460 –based server platform as of March 26, 2010. *Comparisons with single core Intel Xeon® based on pre-production measurements of Intel Xeon® 7500 compared to single core Xeon® from 2005. For notes and disclaimers, see performance and legal information slides at end of this presentation.

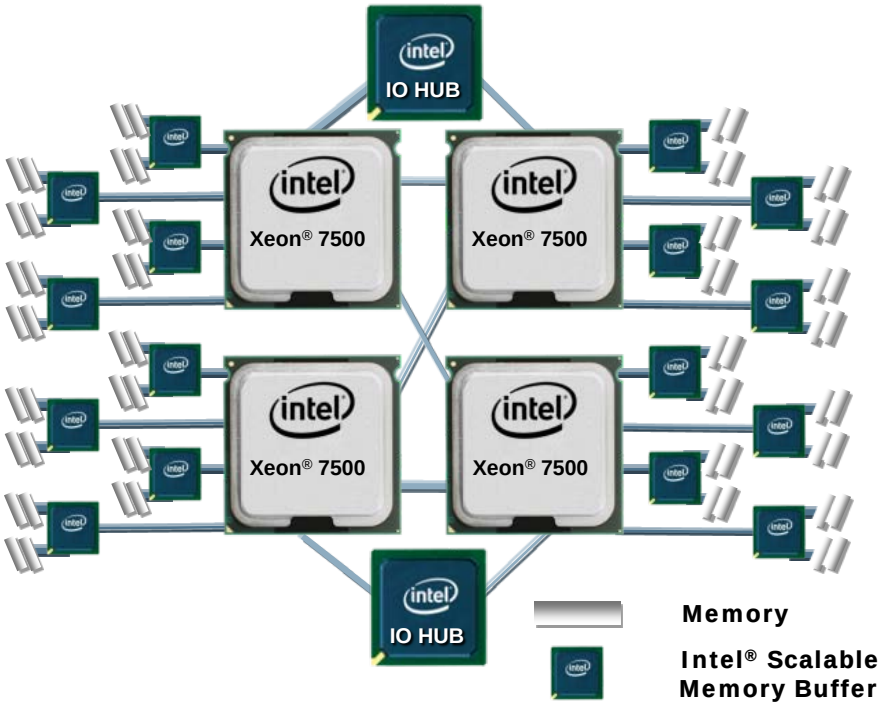
3 Minute

Intel® Xeon® Processor 7500 Series

Nehalem arch optimized for the expandable performance segment

- New processor architecture
- New platform architecture
- New memory subsystem
- New I/O subsystem
- New Mission Critical RAS
- New Levels of Scalability

The biggest performance jump ever in Xeon® history



Scalable Performance

Flexible Virtualization

Advanced Reliability

Intel® Xeon® Processor 7500 Series Benefits

Scalable Performance

Up to **3.7X** performance boost over Xeon® 7400[1]

2 terabyte of memory *(8 sockets)*[2]

2-256 sockets

8X memory bandwidth[3]

Over **20x** performance vs. older, single-core servers[4]

Flexible Virtualization

I/O Virtualization

Intel VT Flex-Migration Assist for virtualization pool investment protection

Advanced Reliability

Over 20 new RAS features[7]

Machine Check Architecture-recovery Recover from fatal errors

Biggest Performance Leap Ever for Xeon[5]

12 Month Refresh ROI[4]

Higher VM Density and Investment Protection

Mission Critical Reliability

1. up to 3.7X over Xeon 7400 vConsolidate using a leading VM vendor. See performance foil for details
2. 8 socket system with 128 DIMM slots populated with 16GB DDR3 DIMMs
3. 8X per Intel internal memory BW measurement 3.2.10
4. Estimate of Xeon 7500 vs older single core 4socket servers. See 20:1 Refresh Foil for details
5. Per published history of Intel Xeon product performance
6. See RAS list for new features

Intel® Xeon® 7500 Processor Series

A Transformational Processor

Transforming Enterprise

- Biggest performance leap in Xeon history[1]
- 20:1 consolidation of older, single-core 4S servers[2]
- Est. 12 month 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]

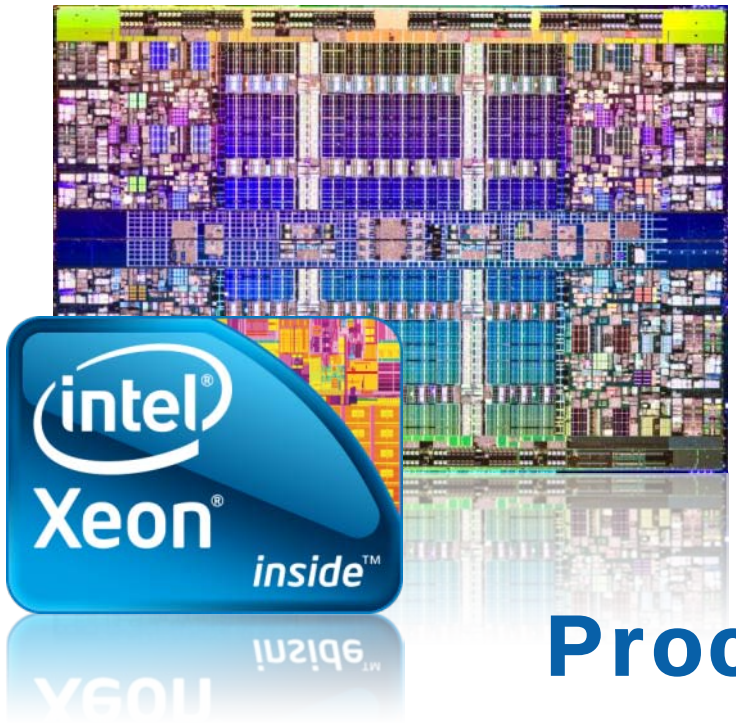
Transforming HPC

- 8X memory bandwidth of prior generation[5]
- 2 terabyte of shared memory capacity (with 8 sockets)[6]
- Super node scaling for largest data intensive problems

Transforming Enterprise, Mission Critical and HPC workloads

1. Per published history of Intel Xeon product performance
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

30 Minute



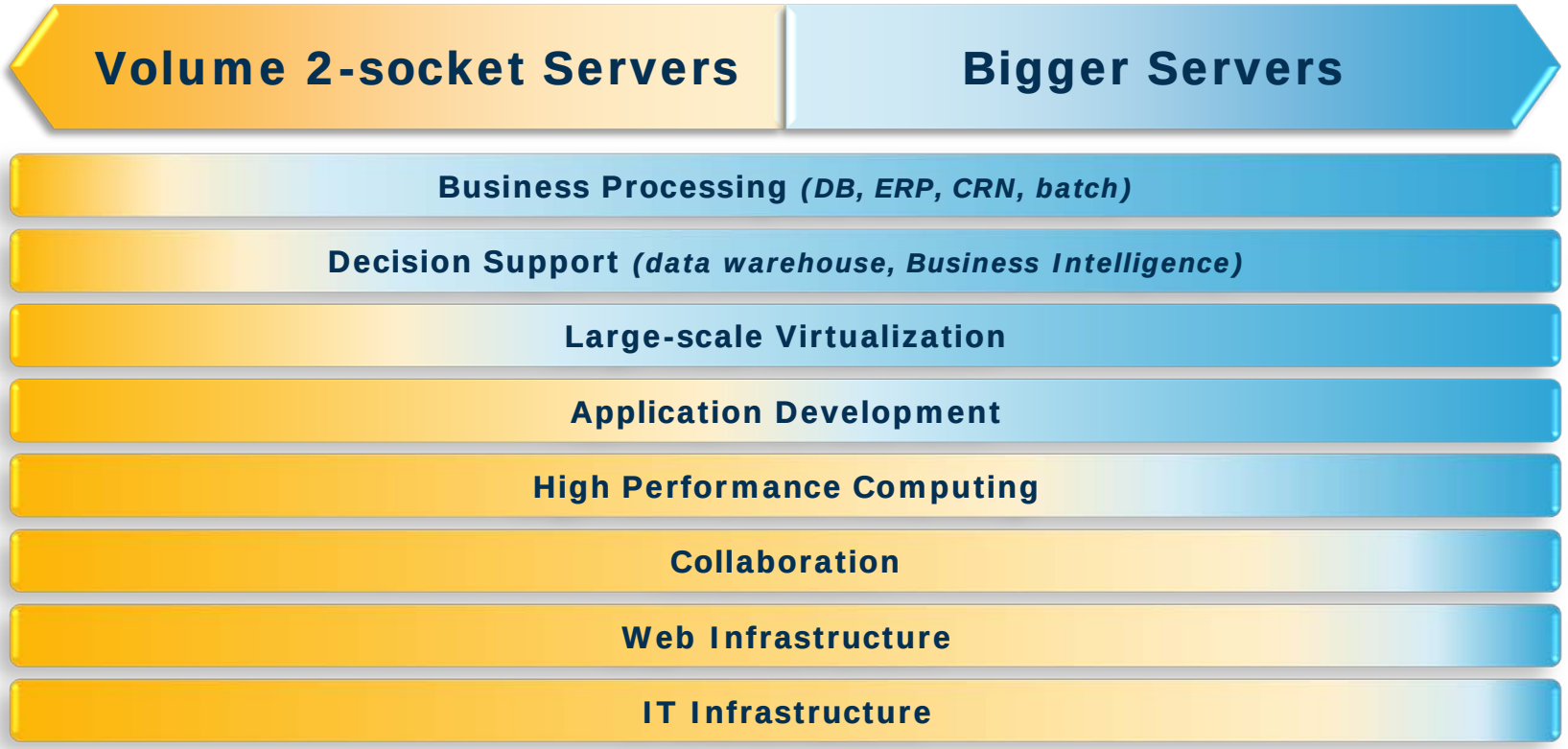
Intel® Xeon® Processor 7500 Series "Nehalem-EX"

<add name>

Agenda

- **Transforming the Big-Server Market**
- **Xeon® 7500 Processor**
- **Scalable Performance**
- **Flexible Virtualization**
- **Advanced Reliability**
- **High Performance Computing**
- **Best Enterprise Solutions**
- **Processor Selection**

Traditional Big Server Usages



The Most Demanding Applications Require Big Server Capabilities

Source: Internal Intel assessment & 2009 IDC Server Workloads Forecast and Analysis Study

Emerging Big-Server Trends

Driving Need for Ever-More Capable Hardware

Big-Server Hardware Requirements

Current Usages and Trends Drive Hardware

- **Bigger Workloads**
- **Higher & Bigger VM Densities**
- **Accelerating RISC Migration**
- **HPC Super Nodes**
- **Ongoing ROI Focus**

HW Requirements

- **Maximum Performance**
- **Expandability**
- **High Availability**
- **Best Performance / $ at Capacity**

Market Need for New Class of More Capable MP Systems

Xeon® 7500…a Quantum Leap

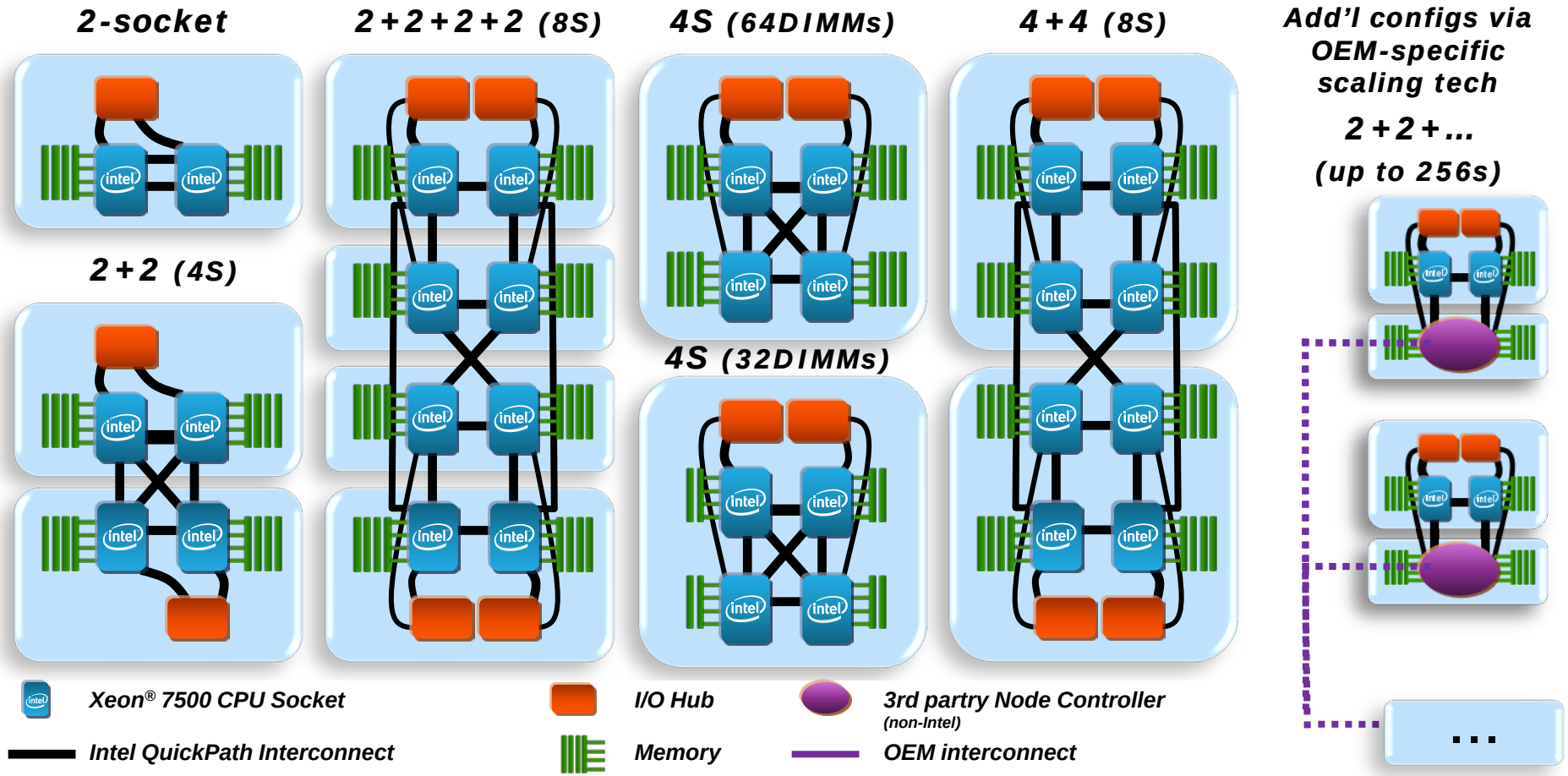
HW Requirements	Xeon® 7500	Xeon® 7500 vs. Xeon® 7400* Up to….
Maximum Performance	• Biggest perf. leap in Xeon History	3.7X
	• Enhanced memory bandwidth	8X
Expandability	• Scaling from 2 to 256 sockets	16X
	• 2 TB memory *(8S glueless; higher w/ node controller)*	8X
	• More & innovative system designs	2X
High Availability	• >20 NEW Reliability Features *(Mission Critical Class Capability)*	3X
Best Performance / $ at Capacity	• Increased Energy Efficiency	2.4X
	• Higher Consolidation Refresh Ratio *(Xeon 7500=20:1; Xeon 7400=8:1)*	2.5X

The biggest performance, capability and reliability leap in Xeon history

**Xeon 7500 offers performance, feature and other metrics "up to" the levels shown
1. Biggest performance leap: Per published history of Intel Xeon product performance
2. 3.7X: Based on March '10 vConsolidate using a leading VM software vendor.
3. 8X per Intel internal memory BW measurement 3.2.10
4. Glueless 8 socket system with 128 DIMM slots populated with 16GB DDR3 DIMMs vs prior generation of 4S gluelsss 32 DIMM slots with 8GB DIMMs
5. 2X number of designs. Intel count of 7400/7300 platforms systems in market vs those coming on Xeon 7500
6. 3X RAS features vs Xeon 7400. Internal count of features.
7. 2.4X energy efficiency. See Energy Efficiency performance slide
8. 2.5X higher consolidation refresh ratio based on ROI tool. Xeon 7500= 20:1 vs older single core 4S servers and Xeon 7400 is 8:1 vs those same servers

Modular Platform Drives Innovation

Wide Range of Xeon® 7500 Platforms Brought to Market



Huge variety of systems available for optimized choice

Advanced Reliability Starts With Silicon

Xeon® 7500 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**

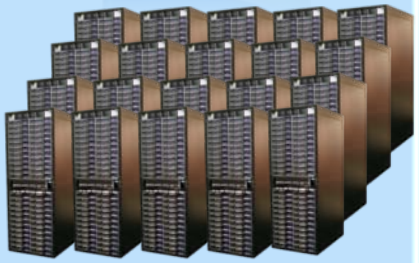
Over 20 New RAS features across the entire platform

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

Server Refresh Benefits

Single Core → Xeon® 7500

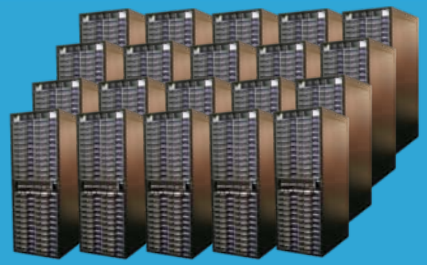
2005



20 Racks of Intel® Xeon® Single Core Servers

2010

Performance Refresh 1:1



20 Racks of Intel® Xeon® 7500 Based Servers

Up to **20x** Performance *(Estimated)*

– OR –

Efficiency Refresh 20:1

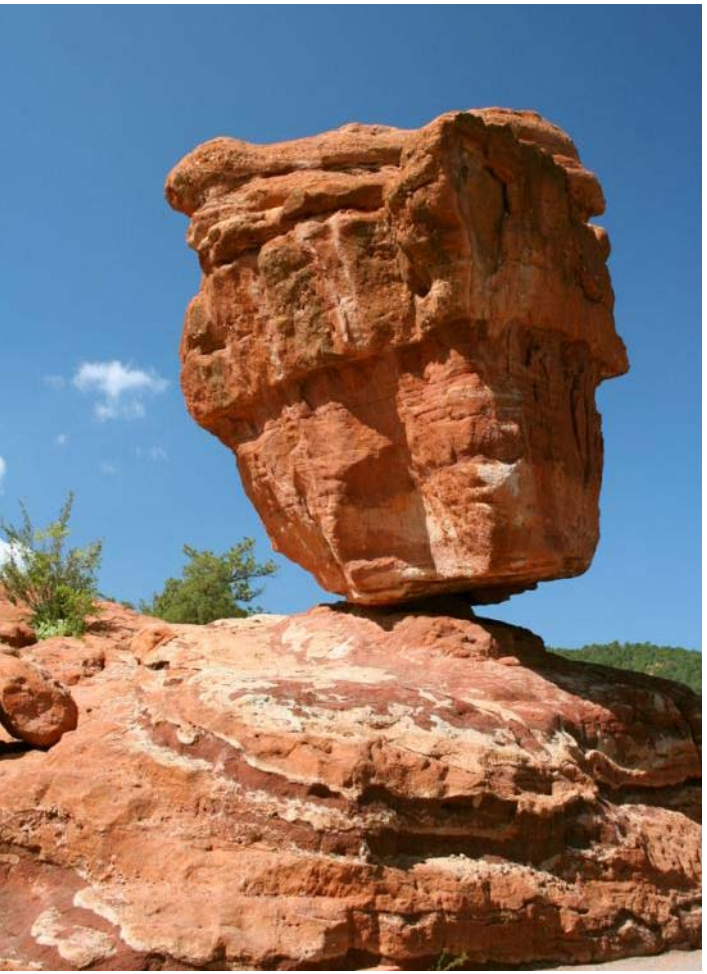
1 Rack of Intel® Xeon® 7500 Based Servers

Up to **92%** Annual Energy Costs Reduction *(Estimated)*

As Little as **12 months** Payback *(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.

Xeon® 7500: A Catalyst for Mission Critical Transformation



- RISC microprocessor volumes continue to decline
- Xeon®-based platform delivers on TCO advantage
- Xeon® 7500 brings the level of mission critical reliability in bigger systems
- IT budgets tighter than ever

"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, IDC

4S Price/Performance vs. RISC

Estimated Performance

SUN T5440 UltraSPARCT2+*	
SPECJbb2005*	2.08x
SPECint*-rate 2006	2.04x
SPECfp*-rate2006	2.14x

Less than 1/2 System Cost

Up to 2X Performance

POWER 550/570 IBM POWER7*	
SPECJbb2005*	0.75x
SPECint*-rate 2006	0.75x
SAP SD 2-tier	0.80x

Less than 1/5 System Cost

Leading Price/ Performance

Source: Intel Internal measurements Aug 2009. See backup for additional details. System pricing based on published System pricing for T5440 with 64GB memory and estimated pricing for 4s Xeon® 7500 system

For notes and disclaimers, see legal information slide at end of this presentation

Xeon® 7500® Expands Intel's Mission Critical Platform Offerings

7000 Sequence

Scalable performance

Flexible Virtualization

Advanced Reliability

9000 Sequence

Architected for Mission Critical UNIX and mainframe

Advanced Reliability

Server Decision Based on Fit to System Deployment Requirements

Operating System	Application Availability	OEM System Capability	OEM Service & Support
✓	✓	✓	✓

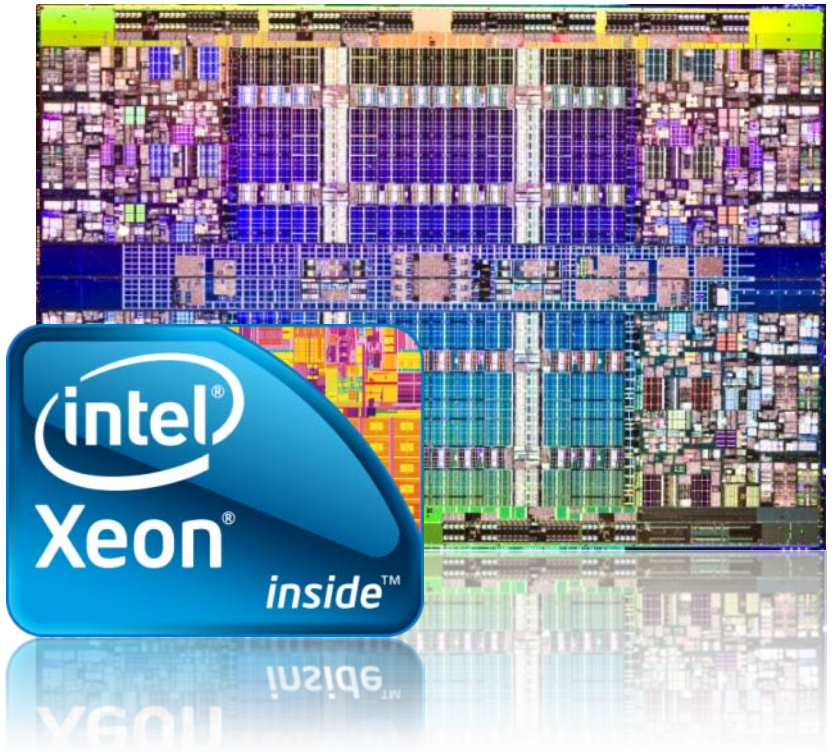
Intel® Xeon® 7500—expanding the options for Mission Critical Workloads

24

- Transforming the Big-Server Market
- **Xeon® 7500 Processor**
- Scalable Performance
- Flexible Virtualization
- Advanced Reliability
- High Performance Computing
- Best Enterprise Solutions
- Processor Selection

Introducing the Intel® Xeon® 7500 Series Processor

Based on the Next Generation Intel® Microarchitecture



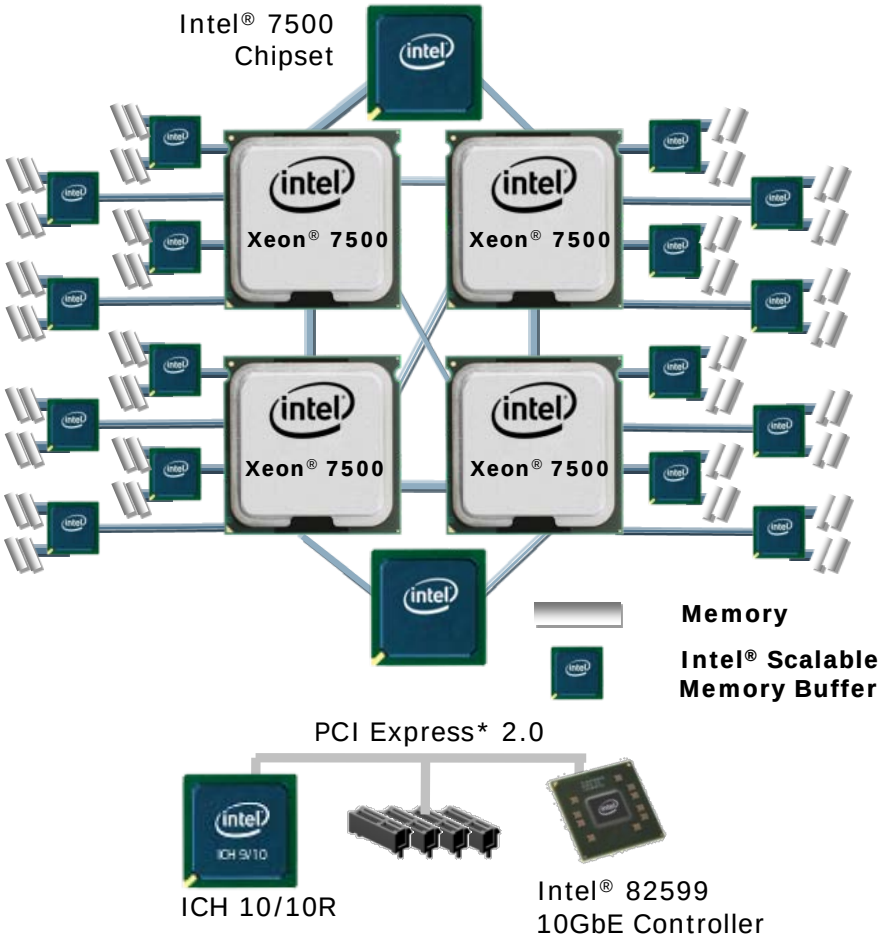
A New Generation of Intelligent Servers

Xeon® 7500

Nehalem Generation Intel® Microarchitecture

Technology Advantages

- Nehalem architecture
- 8-cores
- 24MB Shared L3 Cache
- 64 DIMM slots support up to 1 terabyte of memory (4 sockets)
- 72 PCIe Gen2 lanes
- Scaling from 2-256 sockets
- Intel Virtualization Technologies
- Mission Critical Class Reliability features

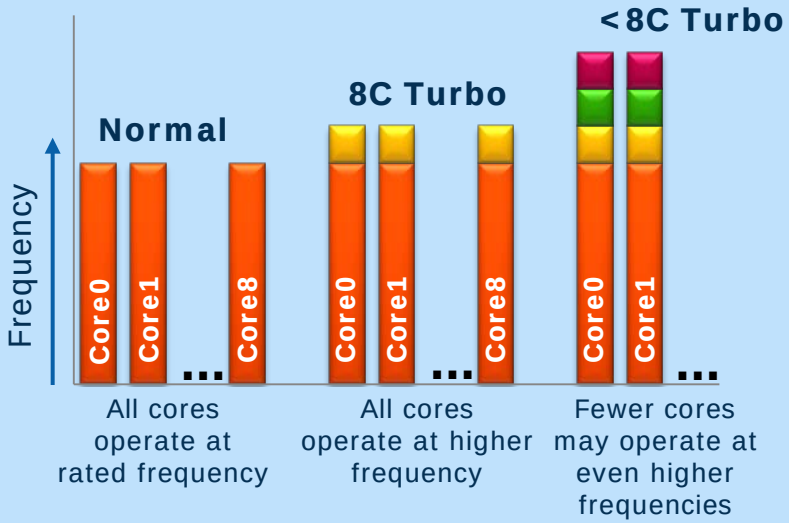


Performance Enhancements

Intel® Xeon® 7500 Series Processor

Intel® Turbo Boost Technology

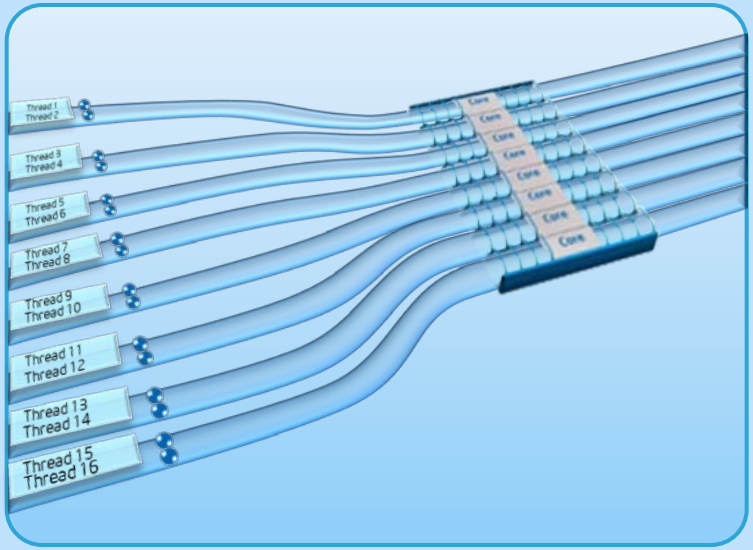
Increases performance by increasing processor frequency and enabling faster speeds when conditions allow



Higher Performance on Demand

Intel® Hyper-threading Technology

Increases performance for threaded applications delivering greater throughput and responsiveness



Higher Performance For Threaded Workloads

Enhancing Platform Value Beyond the Processor

Network Optimizations
- Unified networking
- Eliminate switches/cables
- Scalable with multi-core CPUs

Intel® 10GbE

Impact[1]
- Up to 10X increase IO bandwidth
- >5X port count reduction
- Up to 4.5X power per Gb reduction

Solid State Drives
- Lower power consumption
- No moving parts
- Dramatic performance increases

Intel® X25-M SSDs

Impact[1]
- Up to 46X lower power
- Lower TCO (fewer drives)
- Up to 6X read perf improvement

1 Based on Intel internal results. Actual results may vary significantly based on workload and product configurations. See backup for more details on the results.

- Transforming the Big-Server Market
- Xeon® 7500 Processor
- **Scalable Performance**
- Flexible Virtualization
- Advanced Reliability
- High Performance Computing
- Best Enterprise Solutions
- Processor Selection

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 Expandable Server World Records!

[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.

± Submitted or published Topcrunch.org

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 http://www.intel.com/performance/resources/limits.htm

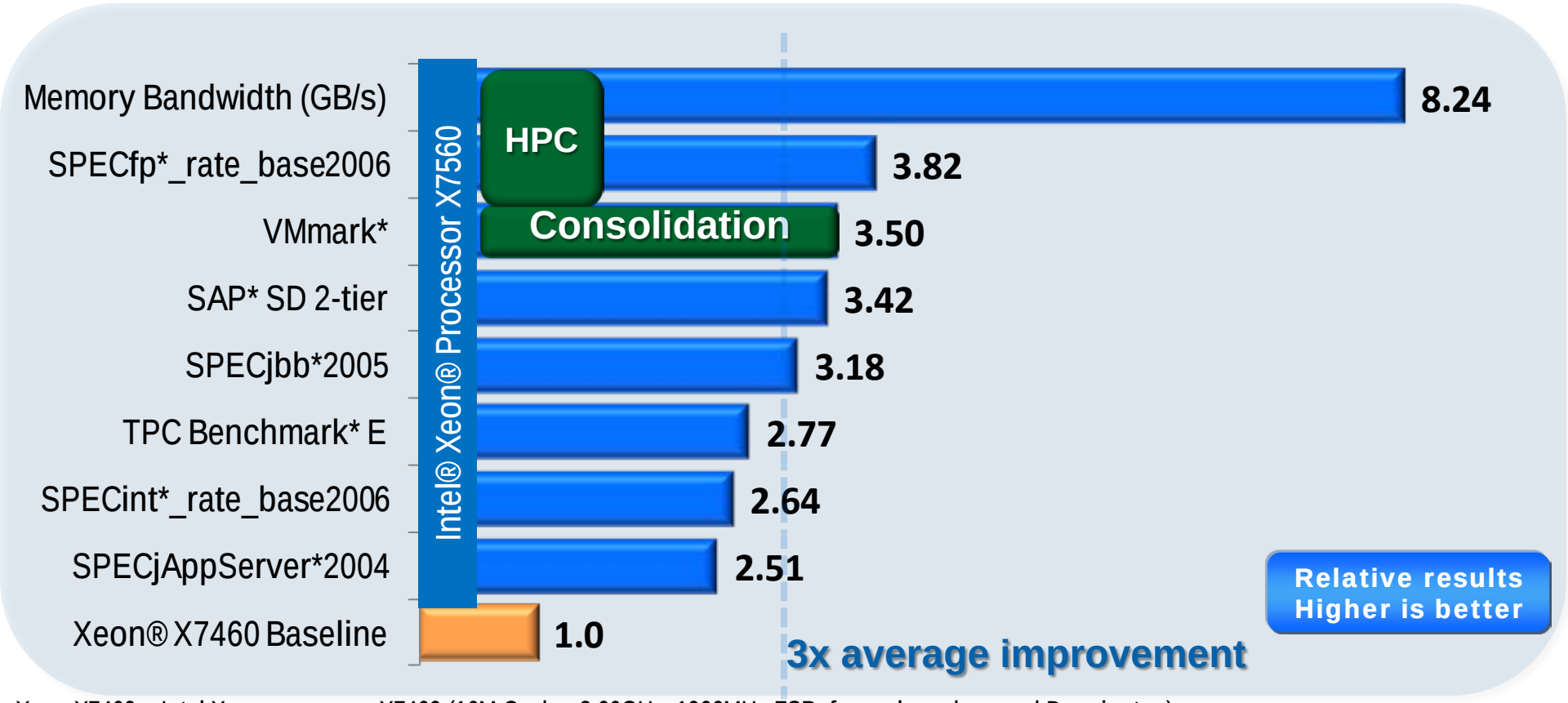
2. NEC: Availability is June 24,2010.

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.

Sponsors of Tomorrow.™

Intel® Xeon® Processor 7500 series-based Servers

4S Standard Benchmarks Performance Summary



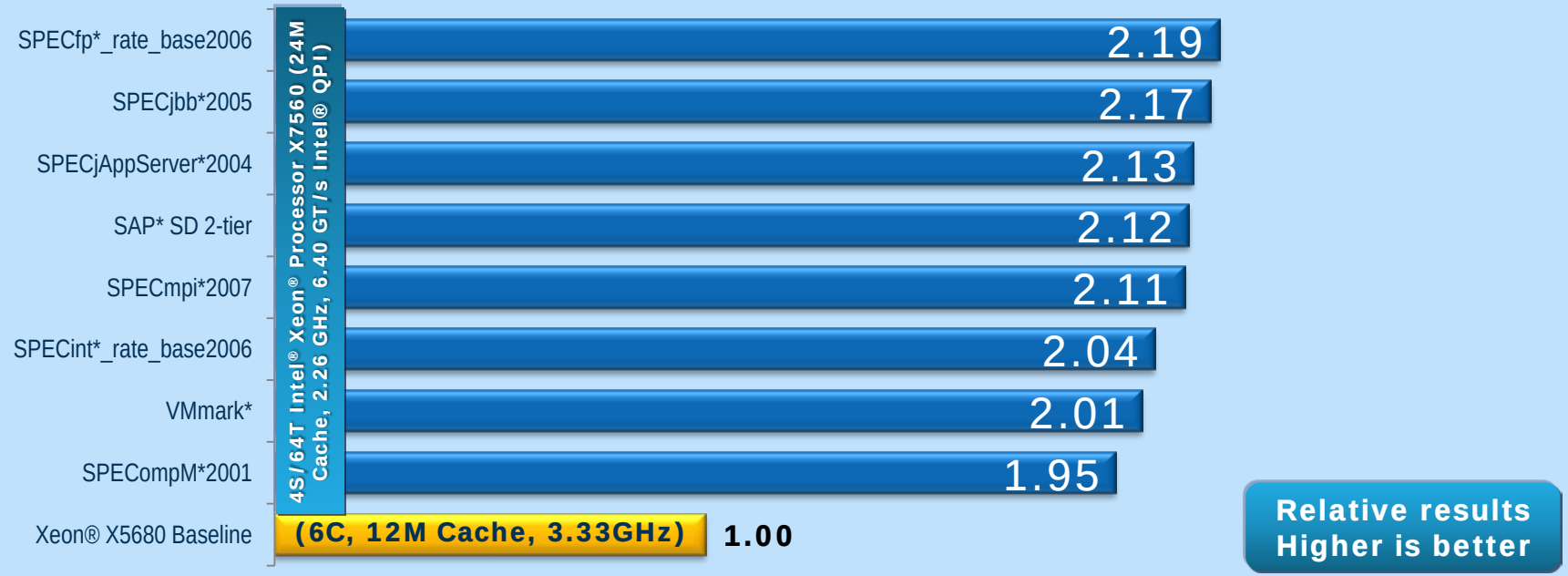
Xeon X7460 = Intel Xeon processor X7460 (16M Cache, 2.66GHz, 1066MHz FSB, formerly codenamed Dunnington)
Xeon X7560 = Intel Xeon processor X7560 (24M Cache, 2.26GHz, 6.40GT/s Intel® QPI, formerly codenamed Nehalem-EX)

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.

Intel® Xeon® Processor 7500

4S Enterprise Standard Benchmarks Comparison to 2S Xeon® 5600 Series



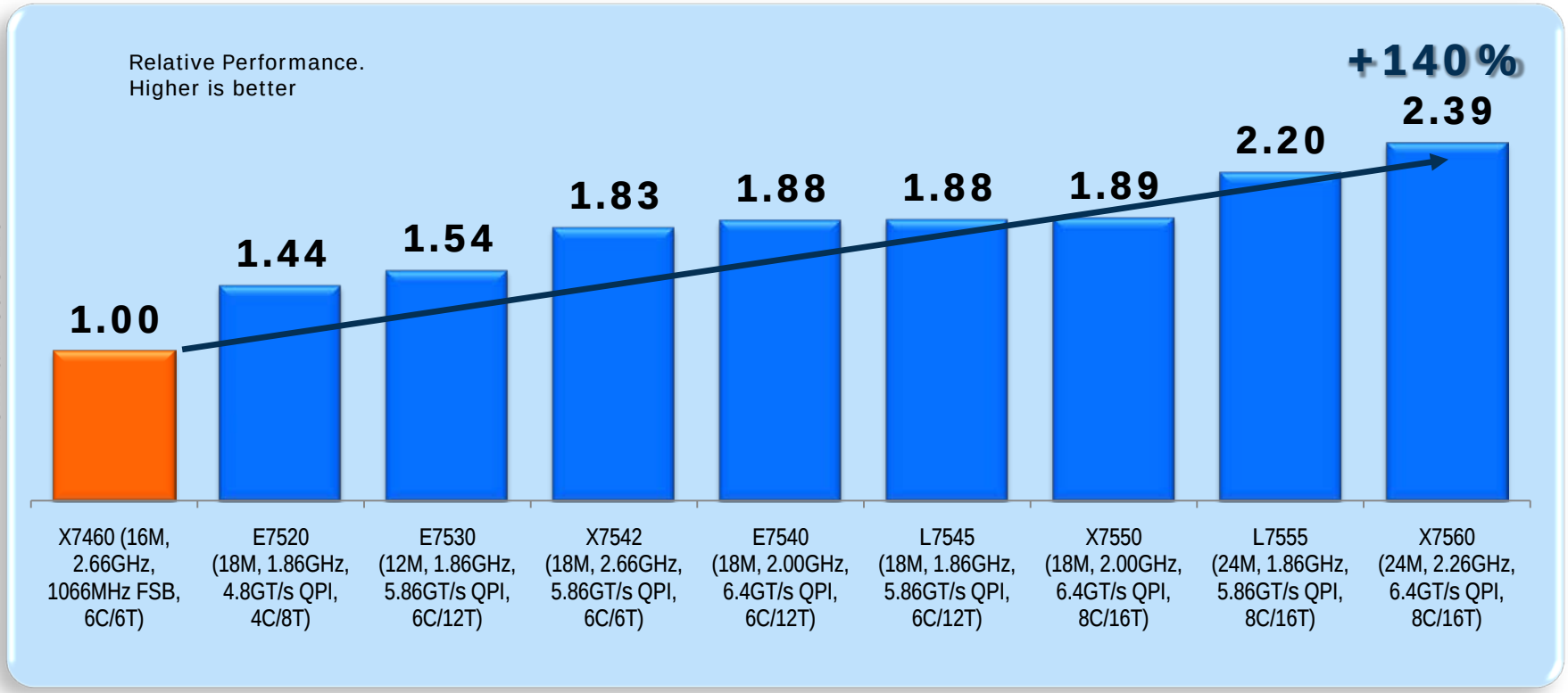
Xeon® 7500 and Xeon® 5600 benchmark results represent best top-bin published results as of 29 March 2010. See notes for details.

Up to 2.2x the performance of Xeon® 5600

Source: Best published results on SPEC.org or VMware.com as of 29 March 2010.
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 http://www.intel.com/performance/resources/limits.htm
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.

Intel® Xeon® Processor 7500

*Performance / Watt: Energy Efficient performance on Server-side Java**



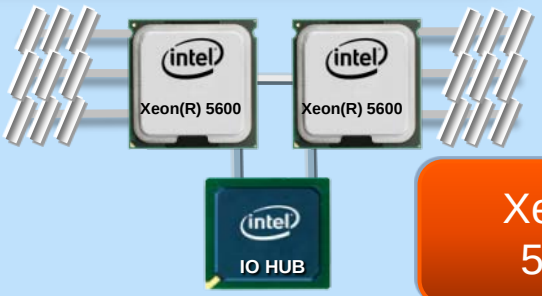
- Compares PPW on baseline Dunnington 4S top-bin to all bins of 4S Xeon 7500 servers
- Significant performance improvements even at the bottom of the product options enables up to 2.4x performance per watt improvement over 7400 series

up to 2.4x Energy-Efficient Performance Improvement

Source: Intel measured results TR#1078 12 February 2010. See backup for additional details.
P=Processors, C=Cores, T=Threads
Xeon X7460 – Intel® Xeon® Processor X7460 (code name "Dunnington ")
Xeon 7500 series – Intel® Xeon® Processor 75xx (code name "Nehalem-EX") – see product details slide for more information or visit www.intel.com/server.
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 http://www.intel.com/performance/resources/limits.htm

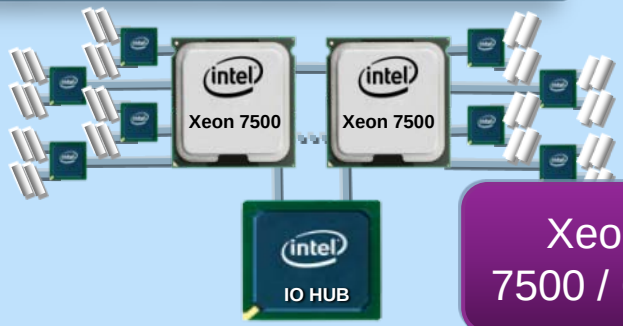
NEW 2-socket Expandable Platform

Efficient Performance Class



Xeon® 5600

Expandable Class



Xeon® 7500 / 6500*

Frequency Sensitive	**Performance**	Thread Sensitive
Low	**Power Efficiency**	High
Low	**Memory Capacity**	High
Good	**Reliability**	Best

Virtualization driving need for compute, memory & reliability

*Use X7560 for highest performance

2-Socket Xeon® 7500/6500 vs Xeon® 5500/6500

Memory Performance Impact of Enabled RAS Features

RAS Feature	Xeon 7500/6500		Xeon 5500/5600	
	Bandwidth	Capacity	Bandwidth	Capacity
x4 SDDC	100%	100%	100%	100%
x8 SDDC	100%	100%	67%	67%
Lock Step	100%	100%	67%	67%
Mirroring	50%	50%	33%	33%
DIMM Sparing	100%	50%	67%	67%
Rank Sparing	100%	50%	Not supported	Not Supported

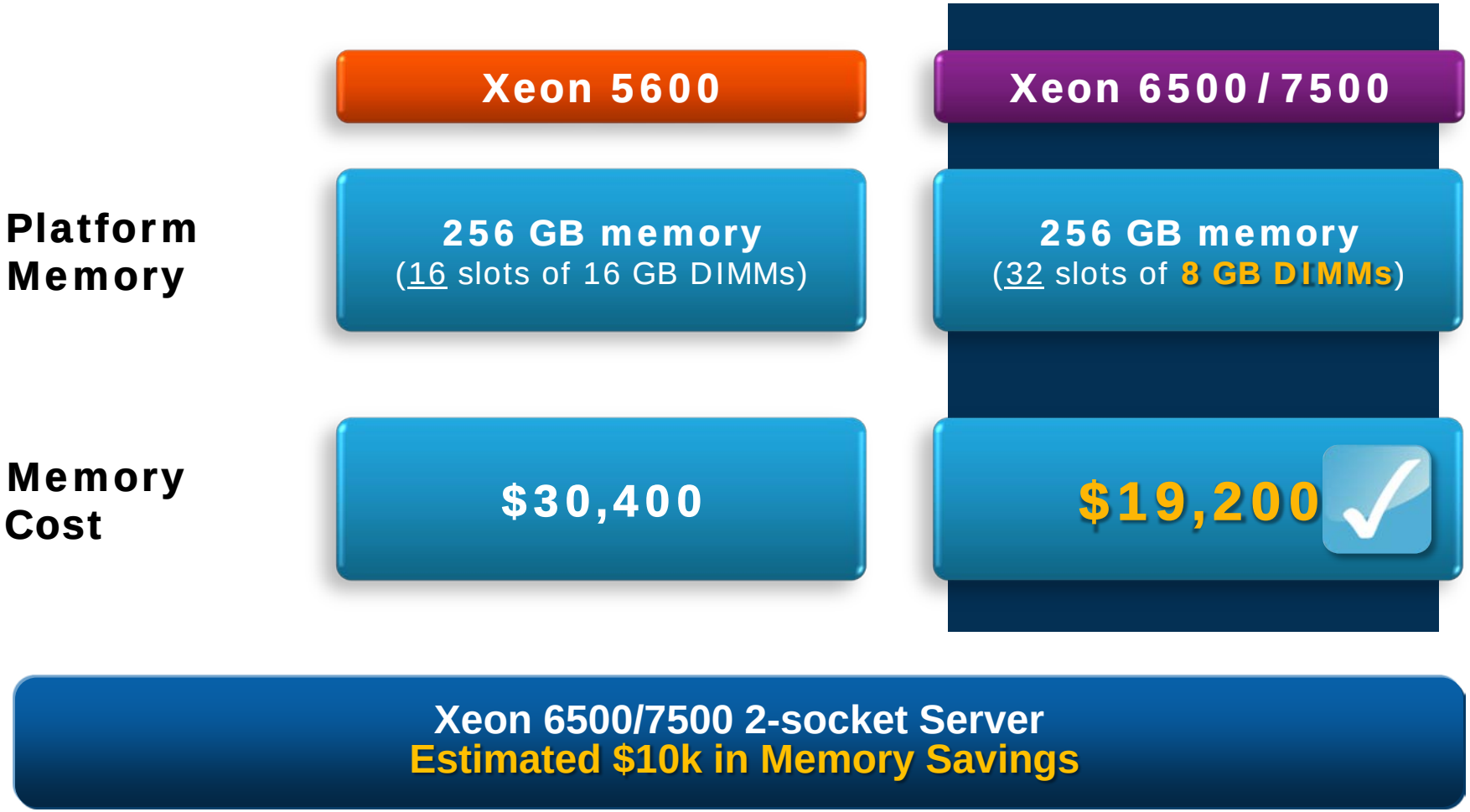
Available Bandwidth and Capacity (Higher is better, 100% is target)

Xeon® 7500/6500: MORE RAS features with LESS adverse performance impact (vs. Xeon® 5500/5600 Series)

Table shows available memory bandwidth and memory capacity when each RAS feature is enabled on each platform vs. the maximum possible bandwidth or capacity for the platform

Advantages of More Memory Slots

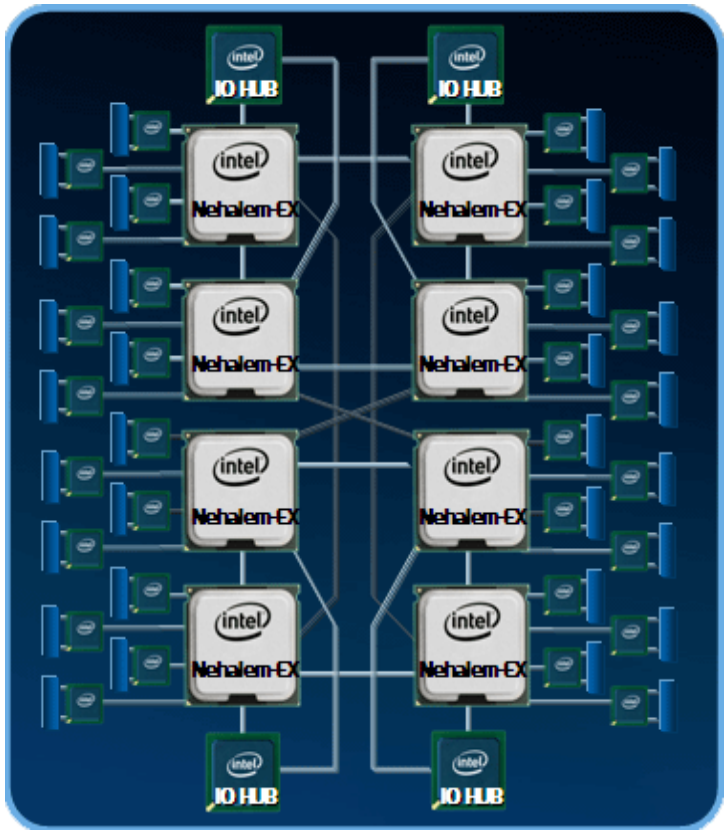
*2-socket EXPANDABLE CLASS Servers**



Xeon 6500/7500 2-socket Server
Estimated $10k in Memory Savings

Performance: Intel internal measurements using Xeon 7500 vs. Xeon 5600 processors in 2 socket servers
Memory cost based on $1900 per 16GB DDR3 ECC RDIMMs and $600 per 8GB DDR3 ECC RDIMMs

Growing Need for 8-socket and Larger Servers



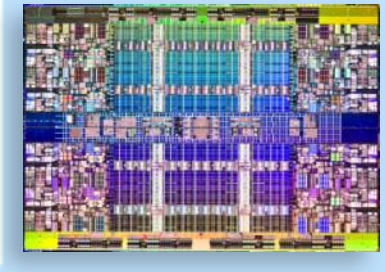
Workload Categories

- **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: Capable of handling the biggest workloads

- Transforming the Big-Server Market
- Xeon® 7500 Processor
- Scalable Performance
- **Flexible Virtualization**
- Advanced Reliability
- High Performance Computing
- Best Enterprise Solutions
- Processor Selection

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

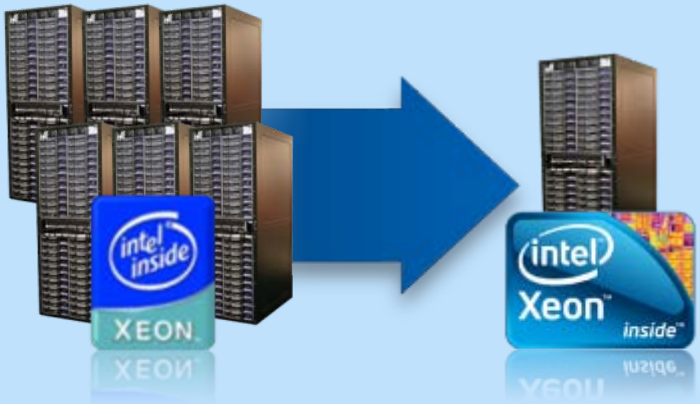
Optimized for the most demanding virtualization workloads

Flexible Virtualization

Through Leadership Processor, Chipset, and I/O Enhancements

Consolidation

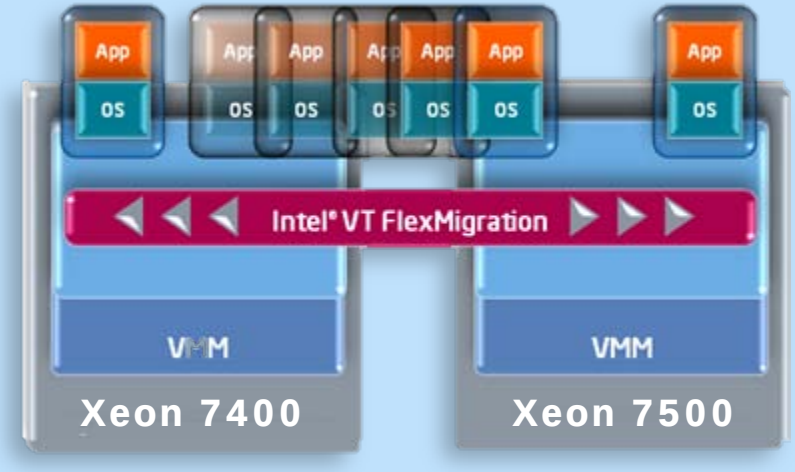
More Resources, Hardware Assist



CapEx and OpEx Reduction
Improved Utilization

Live Migration

Enhanced I/O, Compatible Architecture



Fluid Movement of VMs
Over Network

Virtualization Refresh with Intel Xeon 7500

When simplification and cost reduction is your goal

2005: 40 servers

Single Core

20:1

2010: 2 servers

~$70k HW Investment

New Xeon 7500 series

IT BENEFITS

Floor Space
95%
REDUCTION

Annual Energy Costs
92%
REDUCTION

Business BENEFITS Over 4 years

Lower Operating Costs
$165K
Power / Cooling SAVINGS

Lower Software Costs
$500K
SW Licensing SAVINGS

As low as
8 Month
Estimated Payback

*See foil notes separate detailed calculation foil in backup for more information

- Transforming the Big-Server Market
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- **Advanced Reliability**
- High Performance Computing
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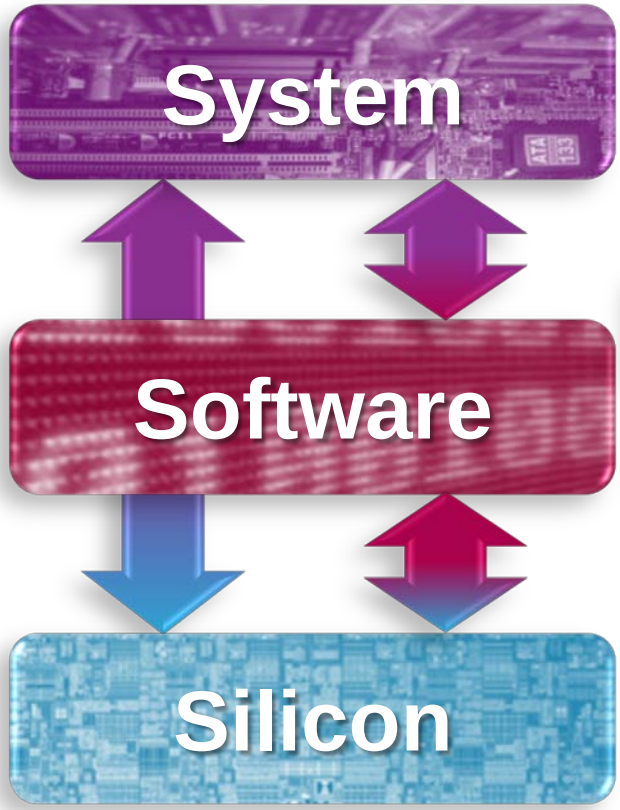
- Processor Selection

Advanced Reliability Starts With Silicon Requires An Ecosystem



Mission Critical OS

solaris
suse
redhat
Windows Server 2008 R2

OEM Innovation

IBM
sgi
hp invent
BULL
NEC
HITACHI
inspur
UNISYS
FUJITSU
ORACLE
CRAY THE SUPERCOMPUTER COMPANY
cisco
DELL

Nehalem-EX Solutions Span Silicon, OS, System

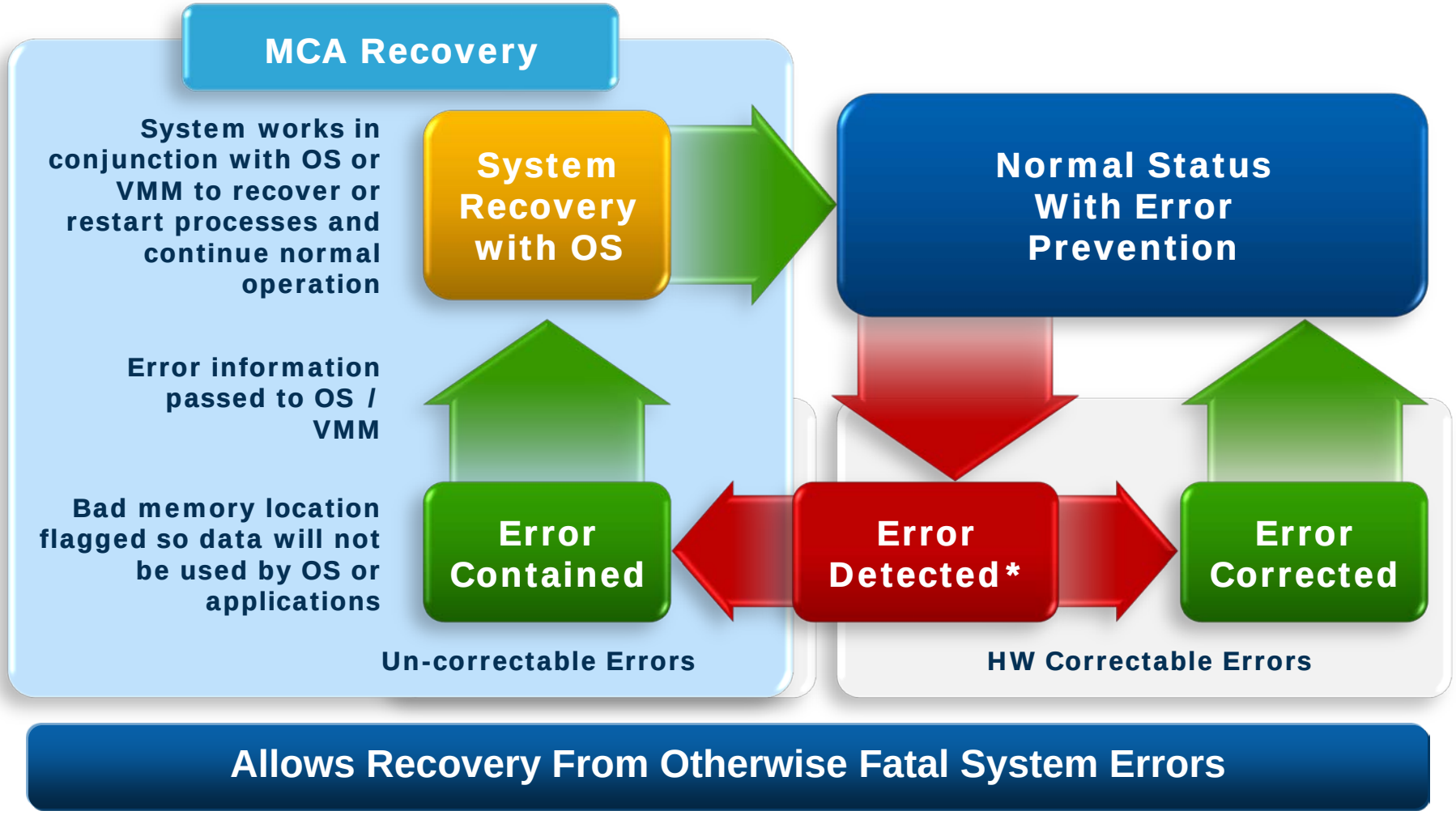
Advanced RAS Delivers Value For IT

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

Machine Check Architecture Recovery

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



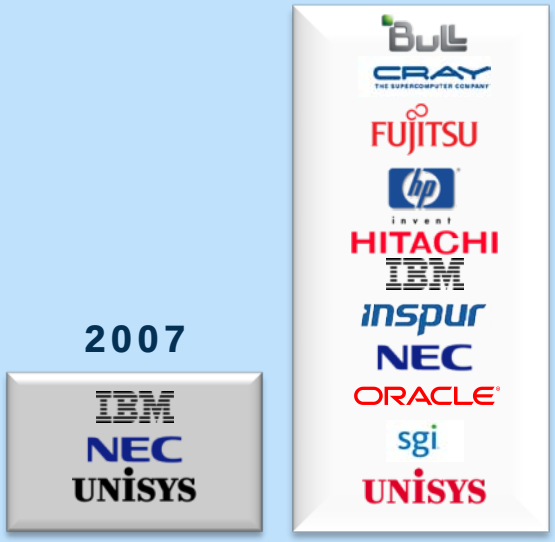
Allows Recovery From Otherwise Fatal System Errors

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

Software Community, OEMs Align around Large Mission Critical Solutions *(8 sockets)*

2010

2007



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

- Transforming the Big-Server Market
- Xeon® 7500 Processor
- Scalable Performance
- Flexible Virtualization
- Advanced Reliability
- **High Performance Computing**
- Best Enterprise Solutions
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Super Node Scalability for HPC

Xeon 7500: Super Node

- Scalable up to 256 sockets
- 8X the memory bandwidth*
- 4X the memory capacity*
- Up to: 50% more cache and 33% more cores*

Transformative Designs

SUPERMICRO

4 Sockets
1U

sgi

256 Sockets
16TB Memory

Wide Spectrum of Available Designs

Ideal for memory capacity bound or core or cache sensitive scale-up workloads

Compared to previous generation Intel® Xeon® 7400 processor series
8X memory bandwidth per Intel internal memory BW measurement 3.2.10

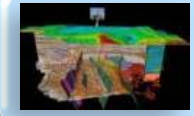
Target HPC Applications for Xeon® 7500

Memory capacity bound

Core or cache sensitive scale-up workloads

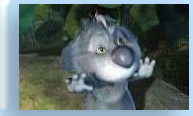
Complexity Reduction
(Larger jobs/fewer nodes)

Manufacturing CAE
CFD Pre-processing
Structural Analysis



Energy
Reservoir Simulation
Seismic (3D Tomography)

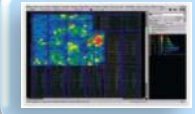
Weather
Numerical weather prediction



DCC
Complex simulation of cloth, fire, smoke, water

FSI
Portfolio Analysis

Life Science
Geonome assembly,
Sequence alignment
Systems biologu
(Large Graph algorithms)

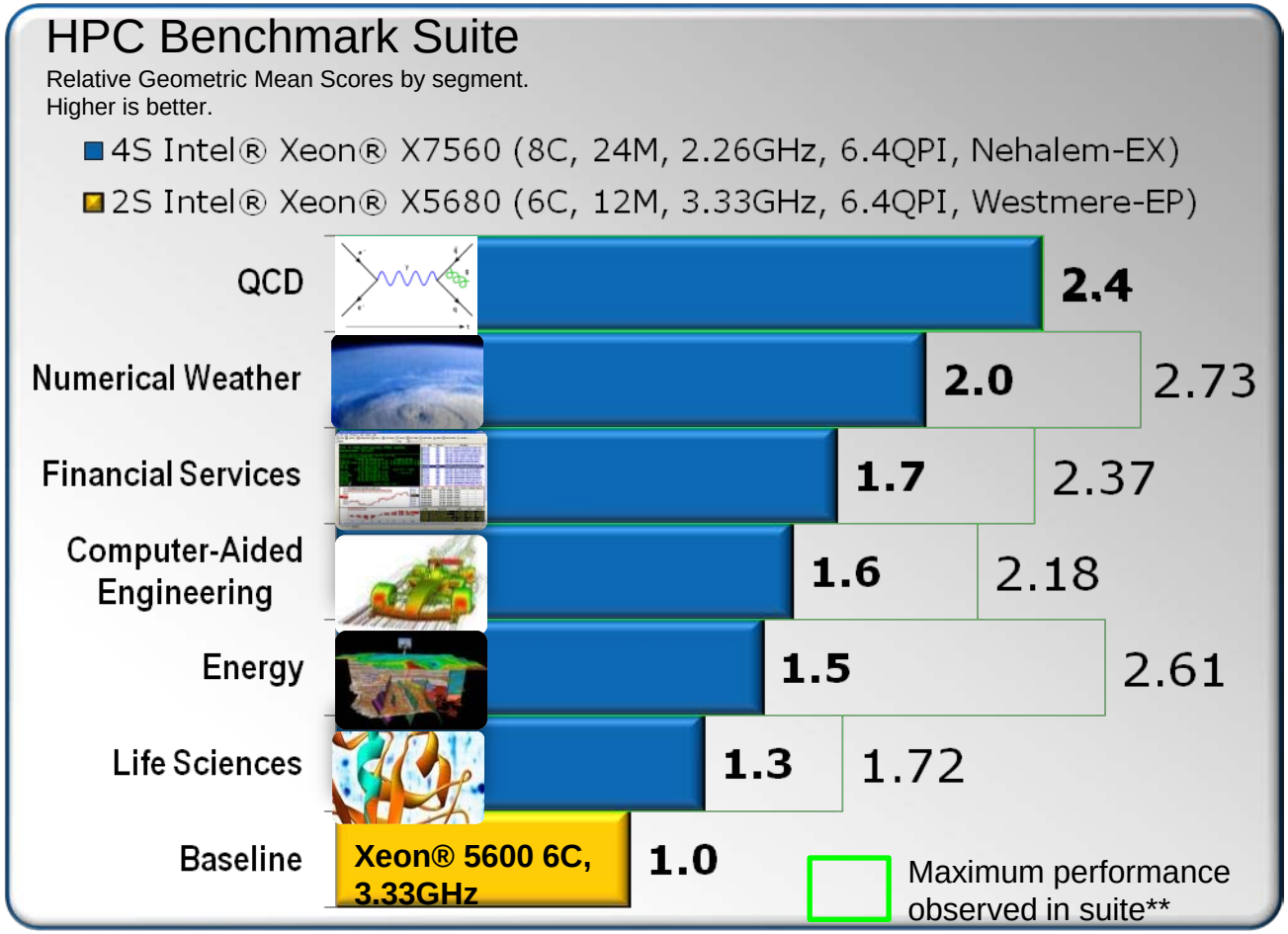


Manufacturing—EDA
“Tape out” – future processors

Xeon® 7500
Super Nodes to Solve HPC’s Largest Data Intensive Problems

Intel® Xeon® 7500 Performance Summary

4S HPC Benchmarks Comparison to Xeon 5600 Series



Xeon 7500 delivers up to 2.4x average / 2.7x max HPC app performance**

Source: Intel Internal measurements Dec 2009. See backup for additional details

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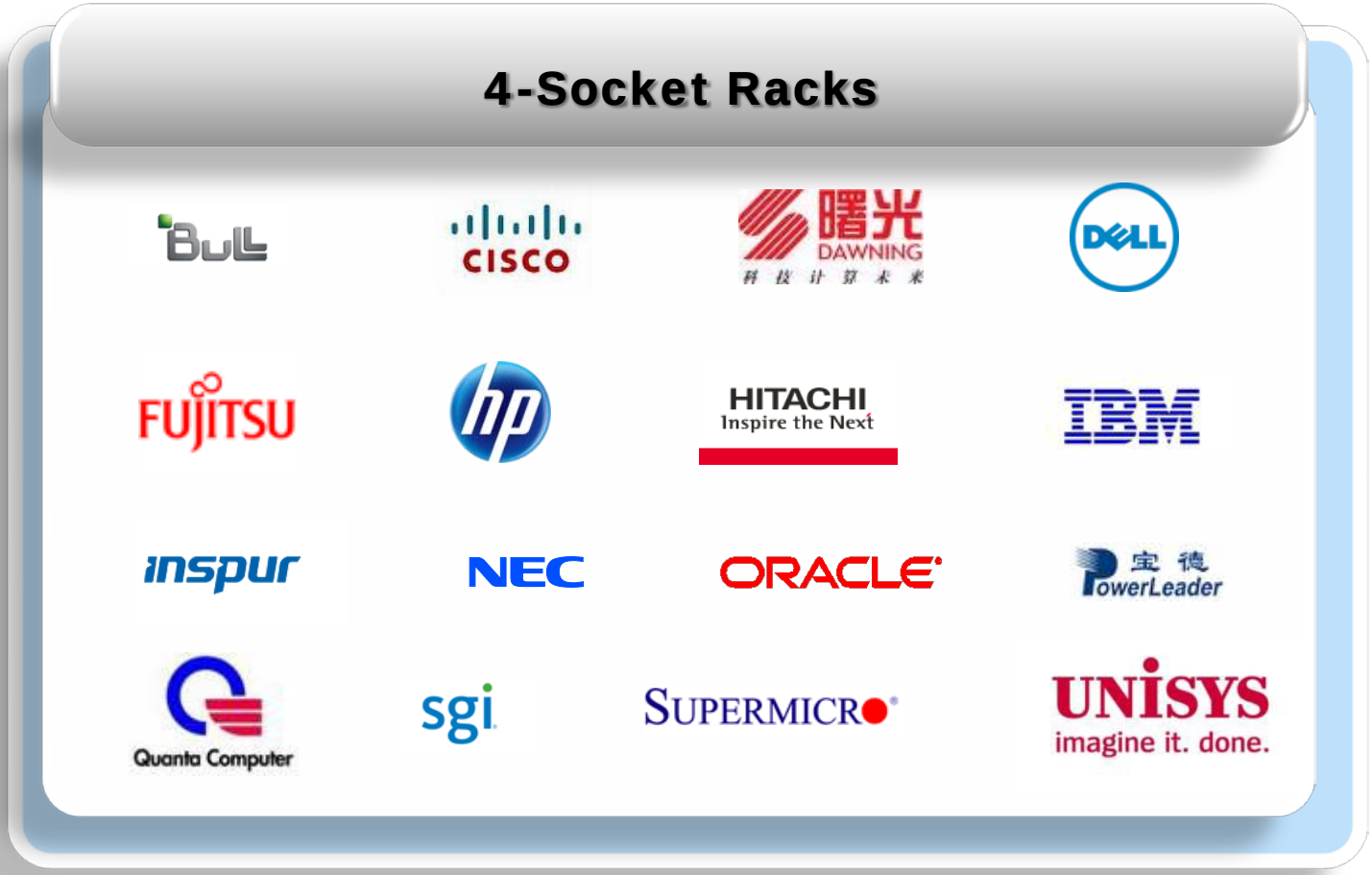
- Processor Selection

OEM System Innovation—4 sockets



More than 2X the number of designs vs prior generation
(including other system sizes and configurations)

[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

Intel® Xeon® 7500--OEM System Innovation

2-socket Expandable

RACKS

DELL IBM

BLADES

DELL HITACHI Inspire the Next

hp IBM

4-Socket Blades

CISCO DELL

FUJITSU HITACHI Inspire the Next

hp IBM

UNISYS imagine it. done.

8-sockets or Greater

FUJITSU BULL

HITACHI Inspire the Next CRAY THE SUPERCOMPUTER COMPANY

IBM hp

inspur

NEC IBM

ORACLE

SUPERMICRO sgi

UNISYS imagine it. done. UNISYS imagine it. done.

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

Greater Choice Way Beyond 4-socket Racks

[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

Intel Xeon 7500 SW Vendor Partners

Sample List

Over 100 Optimized Software Products Around the World!

Catalyst for Mission Critical Ecosystem

Software Vendors Delivering High-end Solution Support for Intel® Xeon® 7500

"With XenApp on the Intel Xeon Processor 7500 Series, we see no barrier whatsoever to running a thousand users per server. We can replace a rack or more of servers with a single server…"

CITRIX®

Simon Crosby, CTO, Data Center and Cloud

"The leadership performance of DB2 on new Intel® Xeon® processor 7500 series based systems is the direct result of the deep collaboration between IBM and Intel, delivering more value …"

IBM

Berni Schiefer, Distinguished Engineer, Information Management Performance and Benchmarks

"The combination of Microsoft's Windows Server 2008 R2, SQL Server 2008 R2, and Intel's Xeon 7500 delivers performance and reliability that was previously only possible on high-priced, power hungry RISC servers and mainframes. Now with the ability to scale up to 256 logical processors…"

Microsoft

Bill Laing, Corporate VP, Windows Server & Cloud Division

"SUSE Linux Enterprise 11 is highly tuned for scalable performance on the Intel Xeon processor 7500 series. With support for up to 2,048 cores…and a range of reliability features to recover smoothly, we expect to see fast adoption as an alternative to expensive proprietary platforms."

Novell®

Carlos Montero-Luque, VP, Business and Product Management, Open Platform Solutions (Linux)

"We've worked very hard to make the Oracle database run extremely efficiently on the Intel platform. With the new Xeon processors, we expect customers to be able to run bigger databases, with much better response times, while paying a lot less."

ORACLE®

Juan Loaiza, Senior Vice President, Systems Technology

"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

"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

"The combination of this new processor family and VMware vSphere™ reduces operational costs and brings higher levels of security and availability to large, business-critical applications running in virtualized environments"

vmware®

Stephen Herrod, CTO and Senior VP, Research and Development

Enthusiastic Early End-User Response

Support for Intel® Xeon® 7500

"The Intel® Xeon® processor 5500 series helped iStreamPlanet stream the 2010 Vancouver Winter Olympics from the Switch Communications Cloud IA in high definition 720p smashing all previous streaming records. Our new infrastructure will be based off of Intel's new Intel® Xeon® processor 7500 series servers which will almost double the bit rates we achieved previously, enabling an even richer user experience including streaming 3D sports."

Mio Babic
Chief Executive Officer
iStreamPlanet

"We want to focus on the science we need to solve for our National Security Mission and not the computer science. Nehalem EX represents a new SMP on a chip super-node that can help us improve our predictive science and simulation capabilities without having to invest in a vast rewrite of our applications."

Mark Seager
Assistant Department Head For Advanced Technologies
Lawrence Livermore National Laboratory

"I had a chance to use a 4 socket, 32 core, Intel® Xeon® 7500 processor series. The large amount of memory available allowed me to do a simulation of a turbulent flow with over 1 billion grid points, something that I could only do five years ago using a supercomputer. Even for larger simulations, the large memory in this platform will enable me to do interactive analysis of large datasets, that will significantly speed up the exploration process necessary in scientific research."

Pablo Mininni
Climate Scientist
National Center for Atmospheric Research

"The large shared memory capability of the Intel® Xeon® processor 7500 series fulfills an essential requirement for high performance applications in the fields of chemistry and solid and fluid mechanics," said TeraGrid Forum chairman John Towns, whose persistent infrastructure team at NCSA will deploy and support Ember. "We selected the SGI Altix® UV systems based on Intel architecture because Ember requires the large shared memory nodes to reliably handle these critical workloads."

John Towns
TeraGrid Forum Chairman
National Center for Supercomputing Applications

"The raw economics of the Intel® Xeon® processor 7500 the cost-to-performance ratio–are compelling. It will help us increase performance and density, and expand our new cloud service, and reduce energy consumption. With every new Intel®-based server we buy, we are running a greener data center."

Todd Mitchell
General Manager, Dedicated Hosting and Global Services
The Planet

"We are planning to certify the DL580 G7 with the Intel® Xeon® processor 7500 series as our top tier server virtualization platform. Today 38% of our servers are virtualized on a platform that we've architected with HP Proliant dual socket 460c blades, supporting one or two virtual CPUs. In order to achieve our IT business plan goal of 78% server virtualization by the end of 2011, we will need the processing power of a quad socket system that can support servers requiring four or eight virtual CPUs. This will allow us to hold our power consumption flat and gain additional years of usable life from our data center, even as we continue to support server growth of 15% per annum."

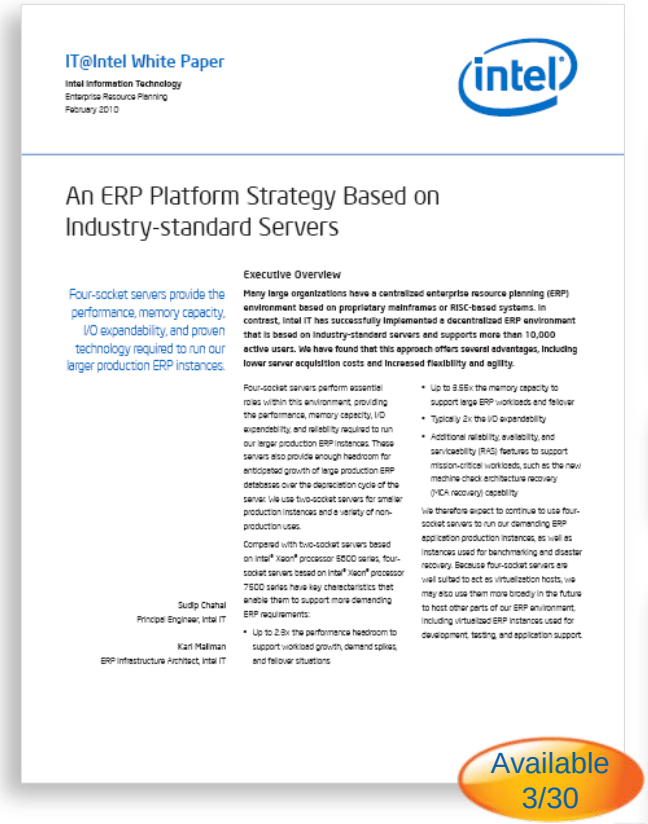
Bruce Philipoom
Vice President, Information Technology
Raymond James & Associates

"The Intel® Xeon® processor 7500 series servers developed by our partners at SuperMicro can deliver 20x more performance per server over the previous generation of processors," said Sam Fleitman, SoftLayer Chief Operations Officer. "This enables higher server consolidation and greater operational efficiency, perfect for our customers with rapidly scaling applications such as web application and social media services. The Intel Xeon processor 7500 series helps them scale fast and scale smart, accommodating growing demand while maintaining a streamlined infrastructure."

Sam Fleitman
Chief Operations Office
SoftLayer

Benefits of 4-Socket for ERP

Intel IT



IT@Intel White Paper

Intel Information Technology
Enterprise Resource Planning
February 2010

An ERP Platform Strategy Based on Industry-standard Servers

Four-socket servers provide the performance, memory capacity, I/O expandability, and proven technology required to run our larger production ERP instances.

Executive Overview

Many large organizations have a centralized enterprise resource planning (ERP) environment based on proprietary mainframes or RISC-based systems. In contrast, Intel IT has successfully implemented a decentralized ERP environment that is based on industry-standard servers and supports more than 10,000 active users. We have found that this approach offers several advantages, including lower server acquisition costs and increased flexibility and agility.

Four-socket servers perform essential roles within this environment, providing the performance, memory capacity, I/O expandability, and reliability required to run our larger production ERP instances. These servers also provide enough headroom for anticipated growth of large production ERP databases over the depreciation cycle of the server. We use two-socket servers for smaller production instances and a variety of non-production uses.

Compared with two-socket servers based on Intel® Xeon® processor 5600 series, four-socket servers based on Intel® Xeon® processor 7500 series have key characteristics that enable them to support more demanding ERP requirements:

- Up to 2.8x the performance headroom to support workload growth, demand spikes, and failover situations
- Up to 8.66x the memory capacity to support large ERP workloads and failover
- Typically 2x the I/O expandability
- Additional reliability, availability, and serviceability (RAS) features to support mission-critical workloads, such as the new machine-check architecture recovery (MCA recovery) capability

We therefore expect to continue to use four-socket servers to run our demanding ERP application production instances, as well as instances used for benchmarking and disaster recovery. Because four-socket servers are well suited to act as virtualization hosts, we may also use them more broadly in the future to host other parts of our ERP environment, including virtualized ERP instances used for development, testing, and application support.

Sudip Chahal
Principal Engineer, Intel IT

Karl Mailman
ERP Infrastructure Architect, Intel IT

Available 3/30

Key characteristics of 4-socket servers based on Intel® Xeon® 7500 series that will be an important consideration in our future ERP platform selection*:

Greater performance headroom to support workload growth, demand spikes, and failover situations

Larger memory capacity to support large ERP workloads and failover

I/O expandability

Reliability, availability, and serviceability (RAS) features to support mission-critical workloads

"Four-socket servers based on Intel Xeon processors provide the performance, memory capacity, I/O expandability, and proven technology required to run our larger production ERP instances."

- Sudip Chahal and Karl Mailman, Intel IT, Intel Corporation

* IT@Intel 2010 white paper: Click here for document
* Compared with two-socket servers based on Intel Xeon processor 5600 series

Oracle Database with Intel Xeon® 7500

When simplification & cost reduction for your DB environment is your goal

2005: 30 servers

Single Core

15:1

2010: 2 servers

~$70k HW Investment

New Xeon® 7500 series

IT BENEFITS

Floor Space
94%
REDUCTION

Annual Energy Costs
90%
REDUCTION

Business BENEFITS Over 4 years

Lower Operating Costs
$200K
Power / Cooling SAVINGS

Lower Software Costs
$1.28M
SW Licensing SAVINGS

As low as
4 Month
Estimated Payback

Source: Intel estimates as of February 2010. Performance comparison using internal workload. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software

- Transforming the Big-Server Market
- Xeon® 7500 Processor
- Scalable Performance
- Flexible Virtualization
- Advanced Reliability
- High Performance Computing
- Best Enterprise Solutions
- **Processor Selection**

Intel® Xeon® Processor 7500/6500 Series Product Options

8 and 4 socket/ Scalable

Usage	Processor Number/Freq	¥Max Scale Glueless	Cores/ Threads	Cache	QPI Speed	Max Mem Speed	TDP	** Turbo	HT
Advanced	X7560 (2.26GHz)	8 skt	8/16	24M	6.4 GT/s	1066 MHz	130W	+3	✓
	X7550 (2 GHz)	8 skt		18M	6.4 GT/s	1066 MHz	130W	+3	✓
Standard	X7542 (2.66GHz)	8 skt	6/6	18M	5.86 GT/s	1066(978) MHz+	130W	+1	No
	E7540 (2 GHz)	8 skt	6/12	18M	6.4 GT/s	1066 MHz	105W	+2	✓
	E7530 (1.86GHz)	4 skt		12M	5.86 GT/s	1066(978) MHz+	105W	+2	✓
Basic	E7520 (1.86GHz)	4 skt	4/8	18M	4.8 GT/s	800 MHz	95W	No Turbo	✓
Low Voltage	L7555 (1.86 GHz)	8 skt	8/16	24M	5.86 GT/s	1066(978) MHz+	95W	+5	✓
	L7545 (1.86 GHz)	8 skt	6/12	18M	5.86 GT/s	1066(978) MHz+	95W	+5	✓

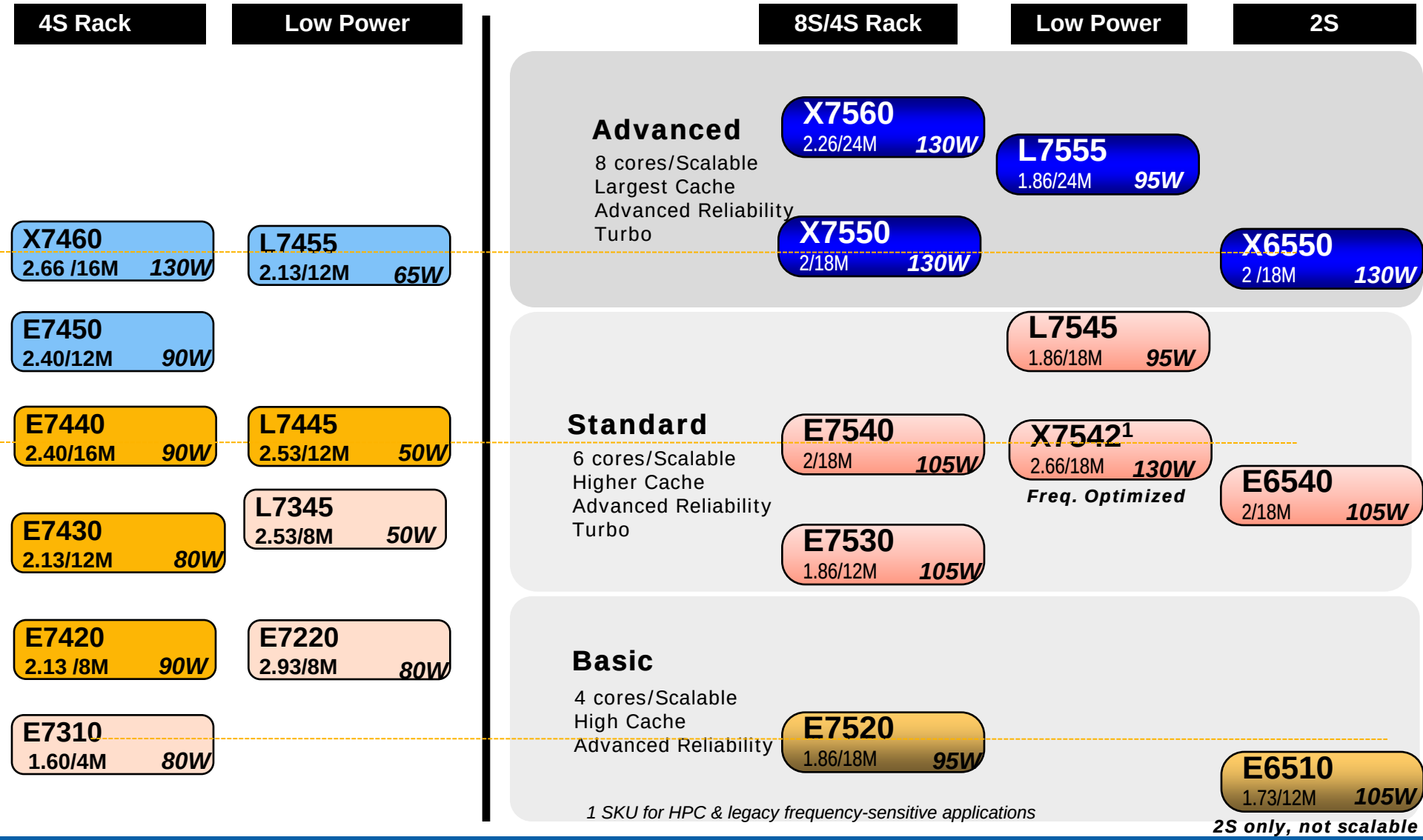
2 socket/ Scalable

Usage	Processor Number/Freq	¥Max Scale Glueless	Cores/ Threads	Cache	QPI Speed	Max Mem Speed	TDP	** Turbo	HT
Advanced	X6550 (2 GHz)	2 skt	8/16	18M	6.4 GT/s	1066 MHz	130W	+3	✓
Standard	E6540 (2 GHz)	2 skt	6/12	18M	5.86 GT/s	1066(978) MHz+	105W	+2	✓
Basic	E6510 (1.73 GHz) 2 skt only	2 skt***	4/8	12M	4.8 GT/s	800 MHz	105W	No Turbo	✓

Advanced features available on higher end processors

+ 1066 Mhz frequency runs at an effective frequency of 978 Mhz when run at 5.86GHz SMI link speed
¥Max Scale Glueless: Scaling capability refers to maximum supported number of CPUs in a "glueless" Boxboro-EX platform (e.g. 8 skt means this SKU can be used to populate up to 8 sockets in a single system)
**Max Turbo Boost frequency based on number of 133 MHz increments above base freq (+2 = 0.266 GHz, +3 = 0.400 GHz)
***E6510 may not be scaled above 2 sockets even with a customer node controller

Product Transition- Xeon 7400 to Xeon 7500



Xeon® 7400 (6 cores)
Xeon® 7400 (4 cores)
Xeon® 7300 (Tigerton, 2 & 4 cores)

Xeon® 7500/6500 (8 cores)
Xeon® 7500/6500 (6 cores)
Xeon® 7500 (4 cores)

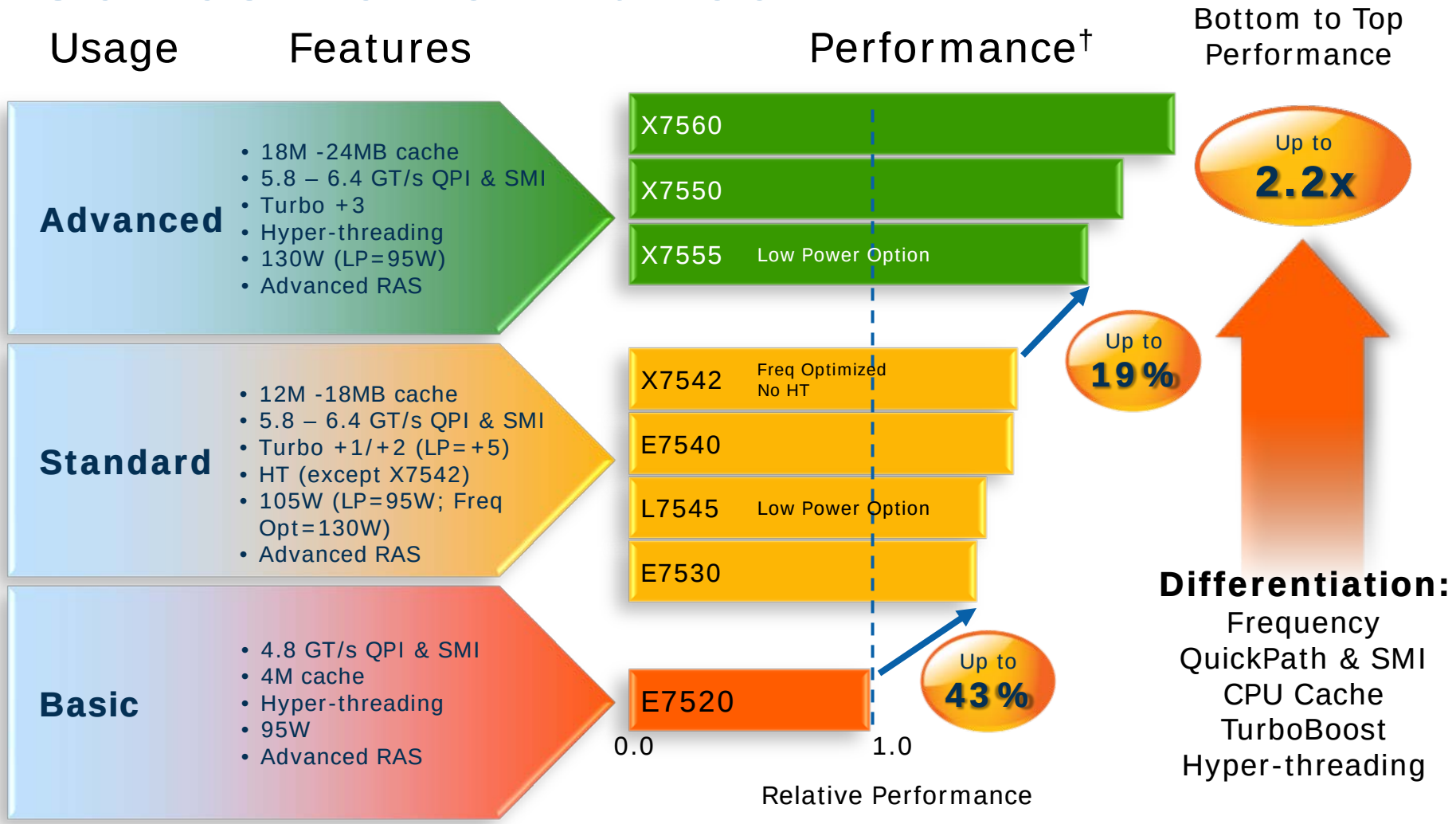
Which Xeon 7500 SKU to Use?

Outstanding Performance/Price results across the Xeon® 7500 stack!

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,

Xeon® 7400 (6 cores)
Xeon® 7400 (4 cores)
Xeon® 7500/6500 (8 cores)
Xeon® 7500/6500 (6 cores)
Xeon® 7500 (4 cores)

Intel® Xeon® Processor 7500 Series Performance



Source: Intel internal estimates TR#1077 using Integer Throughput workload performance as of 19 Feb 2010.

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2S Intel® Xeon® 7500 Platform Advantages *Versus* 2S Intel® Xeon® 5600 Platform

Advanced
Intel® Xeon®
X7560

- 8 cores/16 threads
- 32 DIMMS
- 2.26 Ghz; 24MB cache
- Turbo +3
- Hyper-threading Technology

Advanced
Intel® Xeon®
X5680

- 6 cores/12 threads
- 18DIMMS
- 3.33 GHz ; 12MB cache
- Turbo +2
- Hyper-threading Technology

Up to **87%** **Performance Gain**[1]

33% More Cores

77% More Memory

100% More Cache

Ideal choice for enterprise workloads that benefit from large cache, large memory and advanced reliability features

1 Source: Comparison based on Intel internally measured server-side Java* workload results (TR#1098) as of 29 March 2010. See backup for additional details
Java workload run with lock step RAS feature enabled:
- 2x Intel Xeon X5680 processor (6C/12T, 12M cache, 3.33 GHz, 6.4 Intel® QPI, codename Westmere-EP)
- 2x Intel Xeon X7560 processor (8C/16T, 24M cache, 2.26 GHz, 6.4 Intel® QPI, codename Nehalem-EX)

Advanced reliability features make 2-socket EX very attractive

Intel® Xeon® 7500 Processor Series

A Transformational 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 HPC

- 8X memory bandwidth of prior generation[5]
- 2 terabyte of shared memory capacity *(with 8 sockets)* [6]
- Super node scaling for largest data intensive problems

Transforming Enterprise, Mission Critical and HPC workloads

1. Per published history of Intel Xeon product performance
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

Backup

Expanding Platform Capabilities

	2009 Xeon® 7400		2010 Xeon® 7500			
CPU Sockets	**4S**	**>4***	**2**	**4**	**8**	**>8***
Cores/Threads (per socket)	6/6	OEM dependent	8/16	8/16	8/16	OEM dependent
Cache Size (Level 3)	16MB	OEM dependent	18MB	24MB	24MB	OEM dependent
Max Memory Slots/Capacity	32/ 256GB	OEM dependent	32/ 512GB	64/ 1TB	128/ 2TB	OEM dependent
Max I/O Lanes	28 (Gen1)	OEM dependent	72 (gen2)	72 (gen2)	144 (gen2)	OEM dependent
RAS	Basic	Basic	Advanced	Advanced	Advanced	Advanced*

** Higher scaling accomplished through use of 3rd party OEM chipsets. Platform capabilities of node controller systems vary by OEM*

Expandable Platform Comparison

	Efficient Performance	Expandable			
CPU Sockets	**2**	**2**	**4**	**8**	**>8***
Xeon® Processor Series	5500 5600	6500 7500	7500	7500	OEM dependent
Max Cores & Threads	12/24	16/32	32/64	64/128	OEM dependent
Max Memory Slots	18	32	64	128	OEM dependent
Max Memory Capacity	288GB	512GB	1TB	2TB	OEM dependent
Max I/O Lanes (Gen 2)	72	72	72	144	OEM dependent
RAS Features	Baseline	Advanced	Advanced	Advanced	Advanced

Expandable Platforms: Designed for maximum performance, platform resource scaling, and Reliability

** Higher scaling accomplished through use of 3rd party OEM chipsets.*
Platform capabilities of node controller systems vary by OEM

NEW Intel® Xeon® Processor 6500 Series

	Xeon® 5500	Xeon® 5600	**Xeon® 6500**	Xeon® 7500
uArchitecture	Nehalem	Westmere	**Nehalem**	Nehalem
Platform	Xeon 5500 series	Xeon 5500 series	**Xeon 7500 series**	Xeon 7500 series
Max Sockets Supported	2	2	**2^**	8^
Cores/Threads *(per socket)*	4/8	6/12	**8/16**	8/16
Cache *(level 3)*	8	12	**18**	24
Memory DIMM Slots*	18	18	**32**	128*
RAS	Basic	Basic	**Advanced**	Advanced
Target Usage	High perf	High perf	**Premium**	4S & higher

***New* Xeon® 6500 (2 Socket EX)**
More processing threads, cache, memory capacity & RAS than Xeon® 5000
Ideal for highly threaded, big memory databases & virtualization workloads

^ Sockets supported with Intel platforms only. Higher socket support available via use of 3rd party OEM node controller
** The higher Xeon 7500 memory capacity can be used to populate for highest capacity/performance or enable use of lower cost lower-density DIMMS. 128 DIMM slots supported on 8 socket systems; 4 sockets systems support 64 DIMMs.*

Xeon® 7500 Platform Memory

Intel® Scalable Memory Buffers enable higher memory capacity

- 8 DDR3 channels per socket
- 16 DDR3 DIMMs per socket
- Supports16GB DDR3 DIMMs (1TB with 4 sockets)

Intel® Scalable Memory Interconnects enable matching higher bandwidth*

Memory types supported:

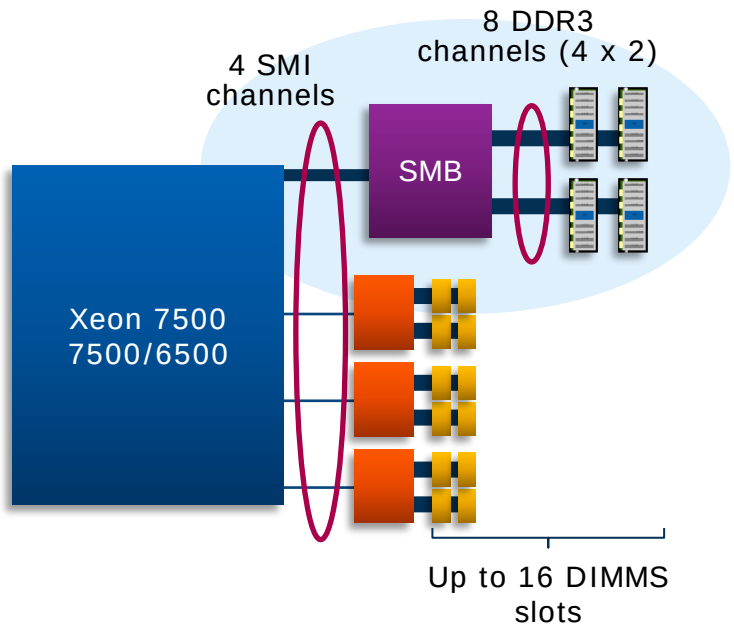
- 1066MHz DDR3 *(800 & 1333MHz depends on OEM validation)*
- Registered (RDIMM); Single-rank (SR), dual-rank (DR), quad-rank (QR)

Actual operational memory speed depends on specific processor capabilities

(see Xeon 7500 SKU stack for max SMI link speeds by part):

- 6.4GT/s SMI link speed capable parts → support up to 1066Mhz
- 5.86GT/s SMI link speed capable parts → support up to 978Mhz^
- 4.8GT/s SMI link speed capable parts → support up to 800Mhz

Memory Per Socket



*Up to 8X vs. Xeon 7400 per Intel internal benchmark measurement
^Example: 1066MHz memory actually operates at 978Mhz

vs Power6

4S Price/Performance vs. RISC

SUN T5440 UltraSPARCT2+*	
SPECJbb2005*	2.08x
SPECint*-rate 2006	2.04x
SPECfp*-rate2006	2.14x

Less than 1/2 System Cost

Up to 2.14X Performance

POWER 550/570 IBM POWER6*	
SPECJbb2005*	4.35x
SPECint*-rate 2006	3.19x
SPECfp*-rate2006	2.88x

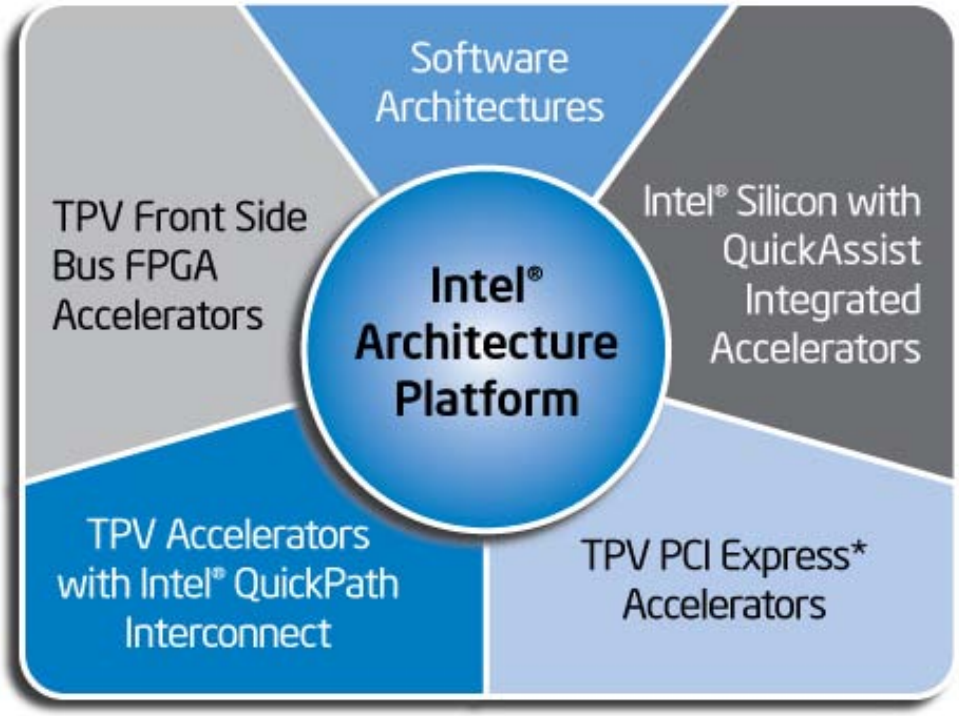
Less than 1/5 System Cost

Up to 4.35X Performance

Source: UltraSPARCT2+ and Power6 results published on spec.org. Intel estimates as of Feb 2010. Intel 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. T5440 actual cost from published pricing information, Estimated price used for 4S Xeon® system, based on existing 4S system published pricing information. Estimated price used for 4S P570 system. Other brands and names are the property of their respective owners.

Innovation on Intel® Xeon® 7500 series In-socket FPGA Accelerators

Intel® QuickAssist Technology



- In-Socket FPGA Demo on Intel® Xeon® 7500 series platform at Spring IDF demonstrating low latency application acceleration.
- FPGA Manufacturers are targeting third party IHV's for 4Q 2010 in-socket FPGA products on Intel® Xeon® 7500 series

Preferred Platform for innovation

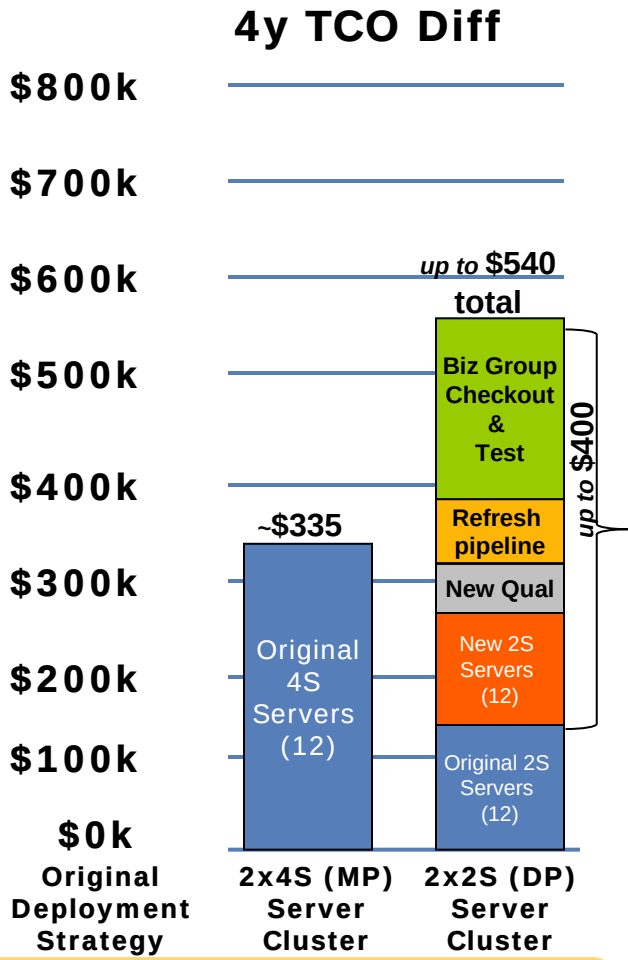
The Costs of Under-Sizing Large Production ERP Instances (If you deployed 2S anyway…)

Hypothetical Example of Costs of Under-sizing server and Additional ERP Infrastructure Upgrades

Mid-life upgrade costs for 2S Infrastructure

Item	Est. Time (Elapsed)	Est. Effort (person-weeks)	Est. Cost ($)
New servers purchase cost $12K/server; 2 servers per instance 6 instances need to be updated Assume that 2S will suffice for upgrade due to tech. advancements	**~1-3 months**	**~1-2**	**$144K**
Qualifying new server platform	**~3 months**	**6-12**	**$12-25K**
Refreshing server platform through the entire pipeline	**~6+ months**	**12-36**	**$25-75K**
Business group checkout and regression Testing	**See above**	**36-72**	**$75-150K**
TOTAL			**$260-400K**

The high logistical complexity of an upgrade makes it very desirable to plan for a 4+ year refresh strategy and avoid mid-life upgrades



Xeon 7500: ~30% lower 4-yr TCO

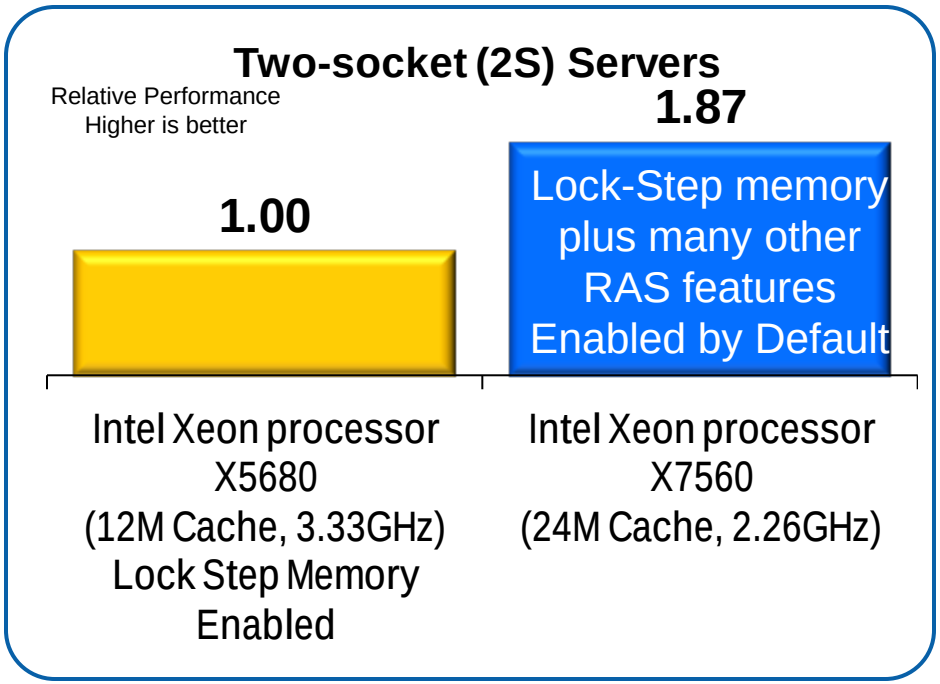
1 Source: Server Acquisition Cost Estimations, based on ~$28k for MP server and $12k for DP Server based on estimated OEM pricing for EX and EP. 12 servers of each of the following:4S System – X7550 8core processors 2 GHz, 128GB (32x4G): $28k -> 2S System – X5670 6 core processors 2.93 GHz, 72GB (18x4G): $12k

Intel® Xeon® Processor 7500 series-based Server platforms

2S Advanced Reliability Features "Enabled" Performance

Advanced reliability performance

- Compares performance of a server-side Java* benchmark on two-sockets Intel® Xeon® processor 5600 series and 2S Intel® Xeon® processor 7500 series server platforms with advanced reliability features (x4/x8 SDDC, Lock-Step memory) enabled on both. For more information, see
- http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00256987/c00256987.pdf.
- Server-side Java* internal workload shows an advantage in performance-and especially when Lock Step memory is enabled for access to enhanced reliability features.
- Intel® Xeon® processor X7560 delivers 87 percent better performance than Intel® Xeon® processor X5680 with advanced reliability features enabled (through Lock Step memory enabled in 5600 series-based server BIOS)
- Advanced reliability and larger memory footprint available on the expandable (EX) 2S Intel® 7500 Chipset-based servers deliver enhanced reliability performance.



NOTE: Intel Xeon processor 5000 sequence-based platforms typically leave Lock Step memory disabled in BIOS due to the performance impact. The customer must choose to enable in BIOS and determine if the performance cost is worth the advanced reliability benefit.

Source: Intel internal measured results February, 2010. See backup for additional details

Advanced reliability without performance compromise – 7500 series delivers up to *87% better performance*^

P=Processors, C=Cores, T=Threads
Xeon X5680 – Intel® Xeon® Processor X5680 ("Westmere-EP", 6-Core, 12M cache, 3.33GHz)
Xeon X7560 – Intel® Xeon® Processor X7560 ("Nehalem-EX", 8-Core, 24M cache, 2.26GHz)

^over X5680 (with RAS features enabled)

Backup – Virtualization Refresh

System Configurations:

4 Socket Single-Core Intel® Xeon® Processor 3.33GHz (Potomac)
Estimated System Power Under Load / Idle Power: 1010W / 562W

4 Socket Intel® Xeon® Processors X7560 (NHM-EX)
System Power Under Load / Idle Power (using 64x4GB dimms): 1560W / 969W

Calculations:

- Integer Performance used as a proxy for Virtualization Performance
- SW Costs: VMWare ESX Maintenance Costs on Old environment comes from Xeon Server Refresh Estimator tool (www.intel.com/go/xeonestimator): $2.3K per server yearly – Assumes SW Support/Maintenance contract transfers from 2 of the old servers to the 2 new. Microsoft Windows Server Enterprise Edition is $1k per server, also from the Xeon Server Refresh Estimator Tool. Assumes licenses transfer.
- Floor space: 4 Racks (320sq. Foot) to just 2 servers within one rack (20% of 1 rack that takes up 80 sq. foot (92% reduction)
- 1s Year Energy Savings: 92% ($43.6k to $3.7k)
- 4 year lower operating costs of $167K
- 4 year lower SW costs of $501K

Projected Cost of Ownership Difference

	Year 0	Year 1	Year 2	Year 3	Year 4		NPC
Server Capital	($70,000)	$0	$0	$0		$0	($70,000)
Capitalized Software Costs	$0	$0	$0	$0		$0	$0
Server Install Costs	($100)	$0	$0	$0		$0	($100)
Server Disposal Costs	($2,000)	$0	$0	$0		$0	($2,000)
Software Validation Costs	($2,000)	$0	$0	$0		$0	($2,000)
Network Expense	$0	$570	$570	$570		$570	$1,627
Utility Expense	$0	$39,960	$41,159	$42,393		$43,665	$118,710
OS Licensing Costs	$0	$0	$0	$0		$0	$0
Application Licensing Costs	$0	$125,400	$125,400	$125,400		$125,400	$358,014
Server Maintenance	$0	$5,000	$5,000	$5,000		$5,000	$14,275
DC Capacity Cost	$0	$0	$0	$0		$0	$0
Depreciation Expense	$0	($17,500)	($17,500)	($17,500)		($17,500)	($49,962)
Tax Shield	$1,558	($58,303)	($58,759)	($59,228)		($59,711)	($166,654)
Total Costs	($72,542)	$112,626	$113,370	$114,135		$114,924	
Cumulative Cash Flows	($72,542)	$40,084	$153,454	$267,590		$382,513	

Cost Category	Year 0	Year 1	Year 2	Year 3	Year 4	Total	NPC
Server Capital	($70,000)	$0	$0	$0	$0	($70,000)	($70,000)
Capitalized Software Costs	$0	$0	$0	$0	$0	$0	$0
DC Capacity Capital	$0	$0	$0	$0	$0	$0	$0
Network and Server Maintenance & Install Costs	($4,100)	$5,570	$5,570	$5,570	$5,570	$18,180	$11,802
Utility Expenses	$0	$39,960	$41,159	$42,393	$43,665	$167,177	$118,710
Annual SW Expenses	$0	$125,400	$125,400	$125,400	$125,400	$501,600	$358,014
Tax Implications	$1,558	($58,303)	($58,759)	($59,228)	($59,711)	($234,444)	($166,654)
Total	**($72,542)**	**$112,626**	**$113,370**	**$114,135**	**$114,924**	**$382,513**	**$251,872**

Backup – Oracle Database Refresh

System Configurations:

4 Socket Single-Core Intel® Xeon® Processor 3.33GHz (Potomac)
Estimated System Power Under Load / Idle Power: 1010W / 562W

4 Socket Intel® Xeon® Processors X7560 (NHM-EX)
System Power Under Load / Idle Power (using 64x4GB dimms): 1560W / 969W

Calculations:

- Database TPC-C* Performance used when comparing old vs. new
- Oracle Database EE Maintenance/Support Costs on Old environment (Single-Core MP) = $20.9k per server. Oracle Database EE Maintenance/Support costs on new Environment (8-core MP) is $167K per server. Reduction of $20.9K per server yearly on 28 servers that will be removed. Assumes SW Support/Maintenance contract transfers from 2 of the old servers to the 2 new as long as the incremental fees are paid.
- Floor space: 30 Servers vs. 2 servers (94% reduction)
- 1s Year Energy Savings: 90% ($54.6k to $5.6k)
- 4 year lower operating costs of $205K
- 4 year lower SW costs of $1.28M

Projected Cost of Ownership Difference

	Year 0	Year 1	Year 2	Year 3	Year 4		NPC
Server Capital	($70,000)	$0	$0	$0		$0	($70,000)
Capitalized Software Costs	$0	$0	$0	$0		$0	$0
Server Install Costs	($100)	$0	$0	$0		$0	($100)
Server Disposal Costs	($1,500)	$0	$0	$0		$0	($1,500)
Software Validation Costs	($2,000)	$0	$0	$0		$0	($2,000)
Network Expense	$0	$420	$420	$420		$420	$1,199
Utility Expense	$0	$49,048	$50,519	$52,035		$53,596	$145,708
OS Licensing Costs	$0	$0	$0	$0		$0	$0
Application Licensing Costs	$0	$320,600	$320,600	$320,600		$320,600	$915,306
Server Maintenance	$0	$3,750	$3,750	$3,750		$3,750	$10,706
DC Capacity Cost	$0	$0	$0	$0		$0	$0
Depreciation Expense	$0	($17,500)	($17,500)	($17,500)		($17,500)	($49,962)
Tax Shield	$1,368	($135,401)	($135,960)	($136,536)		($137,129)	($387,356)
Total Costs	($72,232)	$238,417	$239,329	$240,269		$241,237	
Cumulative Cash Flows	($72,232)	$166,185	$405,515	$645,784		$887,021	

Cost Category	Year 0	Year 1	Year 2	Year 3	Year 4	Total	NPC
Server Capital	($70,000)	$0	$0	$0	$0	($70,000)	($70,000)
Capitalized Software Costs	$0	$0	$0	$0	$0	$0	$0
DC Capacity Capital	$0	$0	$0	$0	$0	$0	$0
Network and Server Maintenance & Install Costs	($3,600)	$4,170	$4,170	$4,170	$4,170	$13,080	$8,305
Utility Expenses	$0	$49,048	$50,519	$52,035	$53,596	$205,198	$145,708
Annual SW Expenses	$0	$320,600	$320,600	$320,600	$320,600	$1,282,400	$915,306
Tax Implications	$1,368	($135,401)	($135,960)	($136,536)	($137,129)	($543,658)	($387,356)
Total	**($72,232)**	**$238,417**	**$239,329**	**$240,269**	**$241,237**	**$887,021**	**$611,963**

12 Month Single Core Refresh ROI Claim – Back Up

- 12 month ROI claim estimated based on comparison between 4S Intel® Xeon® MP CPU 3.3Ghz (Single core w/ HT, 1MB L2, 8MB L3, Potomac) and 4S Intel® Xeon® X7560 (8 core, 2.26GHz) based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 42U 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 $36,000 based on estimated list prices, and estimated server utilization rates. All dollar figures are approximate. SPECint_rate_base2006* performance and power results are measured for X7560 and Xeon 3.3GHz based servers. Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 20x.
  - Baseline platform (measured score of 33.8): Intel server with four Intel® Xeon® MP CPU 3.3Ghz (single core w/HT, 1MB L2, 8MB L3) processors, 16GB memory (8x2GB DDR2-400), 2 hard drives, 1 power supply, using Redhat EL 5.3 x86_64 operating system
  - New platform (measured score of 709): Intel internal reference server with four Intel® Xeon® Processor X7560 (24M Cache, 2.26 GHz, 6.40 GT/s Intel® QPI, Intel Hyper-Threading Technology, Intel Turbo Boost Technology), 128GB memory (64x 2GB QR DDR3-1333), 1 hard drive, 2 power supplies, using SuSE* LINUX 11, cpu2006.1.1.ic11.1.linux64.binaries.nov242009.tar.bz2 binaries.
- 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.

Source: 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.

SKU comparison of SPEC CPU2006

SKU comparison using SPECint*_rate_base2006 (“Base result”)

Intel® Xeon® processor X7500 series-based platform details

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor X7560 (8-Core, 2.26 GHz, 24MB L3 cache, 6.4GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of January 2010. Score: SPECint_base2006 (score 27.5), SPECint2006 (score 32.2), SPECfp_base2006 (score 34.4), SPECfp2006 (score 38.2); SPECint_rate_base2006 (score 705), SPECint_rate2006 (score 757), SPECfp_rate_base2006 (score 539), SPECfp_rate2006 (score 558).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor X7550 (8-Core, 2.00 GHz, 18MB L3 cache, 6.4GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of January 2010. Score: SPECint_base2006 (score 24.4), SPECint2006 (score 28.5), SPECfp_base2006 (score 32.2), SPECfp2006 (score 35.2); SPECint_rate_base2006 (score 635), SPECint_rate2006 (score 680), SPECfp_rate_base2006 (score 501), SPECfp_rate2006 (score 516).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor X7542 (6-Core, 2.66 GHz, 18MB L3 cache, 5.86GT/s QPI), EIST Enabled, Turbo Boost Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of January 2010. Score: SPECint_base2006 (score 27.0), SPECint2006 (score 32.1), SPECfp_base2006 (score 34.7), SPECfp2006 (score 38.2); SPECint_rate_base2006 (score 499), SPECint_rate2006 (score 532), SPECfp_rate_base2006 (score 423), SPECfp_rate2006 (score 438).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor E7540 (6-Core, 2.00 GHz, 18MB L3 cache, 6.4GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of February 2010. Score: SPECint_base2006 (score 23.6), SPECint2006 (score 27.2), SPECfp_base2006 (score 31.4), SPECfp2006 (score 34.1); SPECint_rate_base2006 (score 492), SPECint_rate2006 (score 531), SPECfp_rate_base2006 (score 417), SPECfp_rate2006 (score 434).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor E7530 (6-Core, 1.86 GHz, 12MB L3 cache, 5.86GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of February 2010. Score: SPECint_base2006 (score 21.7), SPECint2006 (score 24.7), SPECfp_base2006 (score 29.3), SPECfp2006 (score 31.6); SPECint_rate_base2006 (score 446), SPECint_rate2006 (score 479), SPECfp_rate_base2006 (score 370), SPECfp_rate2006 (score 383).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor E7520 (4-Core, 1.86 GHz, 18MB L3 cache, 4.8GT/s QPI), EIST Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of February 2010. Score: SPECint_base2006 (score 20.0), SPECint2006 (score 22.7), SPECfp_base2006 (score 26.4), SPECfp2006 (score 28.5); SPECint_rate_base2006 (score 310), SPECint_rate2006 (score 336), SPECfp_rate_base2006 (score 272), SPECfp_rate2006 (score 281).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor L7555 (8-Core, 1.86 GHz, 24MB L3 cache, 5.86GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of February 2010. Score: SPECint_base2006 (score 25.0), SPECint2006 (score 30.3), SPECfp_base2006 (score 31.3), SPECfp2006 (score 35.3); SPECint_rate_base2006 (score 595), SPECint_rate2006 (score 642), SPECfp_rate_base2006 (score 468), SPECfp_rate2006 (score 483).

New Configuration and Score on Benchmark: Intel® Emerald Ridge SDP with four Intel® Xeon® Processor L7545 (6-Core, 1.86 GHz, 18MB L3 cache, 5.86GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, 256GB memory (64x 4GB Quad-Rank DDR3-1066 REG ECC), 146 GB SAS 10000RPM HDD, SuSE* Linux Enterprise Server 11 for x86_64. Source: Intel internal testing as of February 2010. Score: SPECint_base2006 (score 24.5), SPECint2006 (score 29.2), SPECfp_base2006 (score 31.7), SPECfp2006 (score 35.1); SPECint_rate_base2006 (score 457), SPECint_rate2006 (score 495), SPECfp_rate_base2006 (score 387), SPECfp_rate2006 (score 402).