Dual Core Value Proposition and Competitive Comparison

Tuesday May 3, 2005

2:00 p.m. Eastern/ 11:00 a.m. Pacific

Welcome

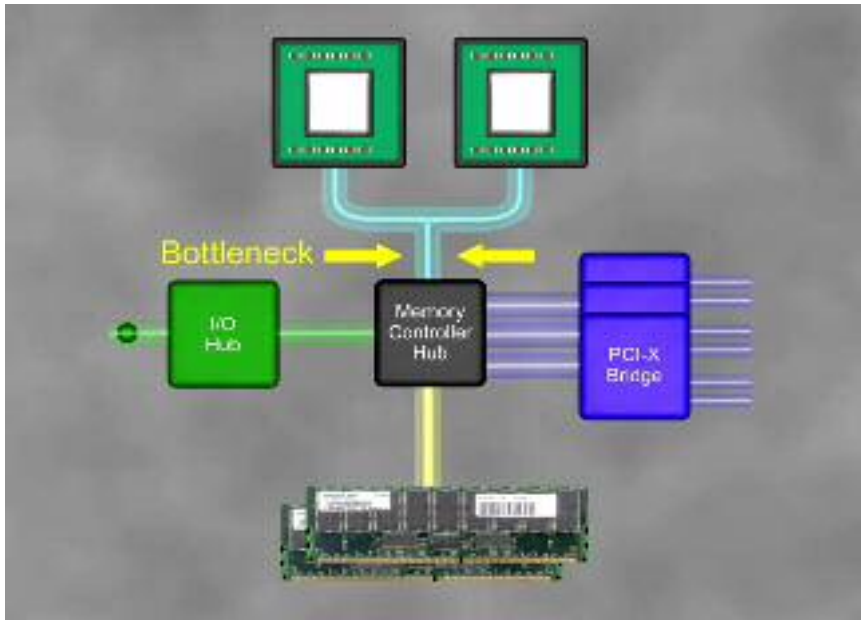
Michael Krieger
VP, Market Experts Group
Ziff Davis Media

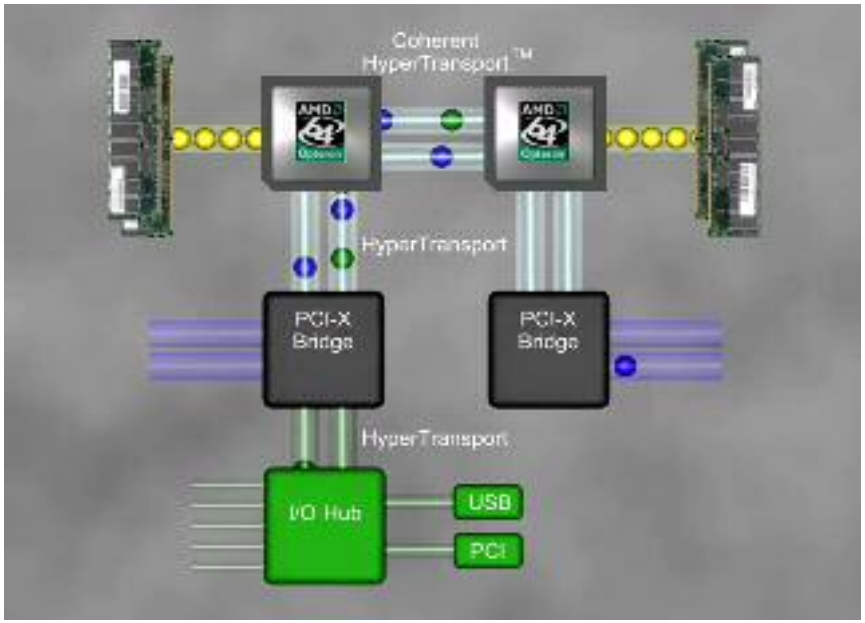
Featured Speakers

Steve Cumings
Group Manager,
ISS Server Platforms Marketing
Industry Standard Servers
HP

Patrick Patla
Director,
Server and Workstation Business Segment
AMD

Architecture for the way you compute today





The Spin:

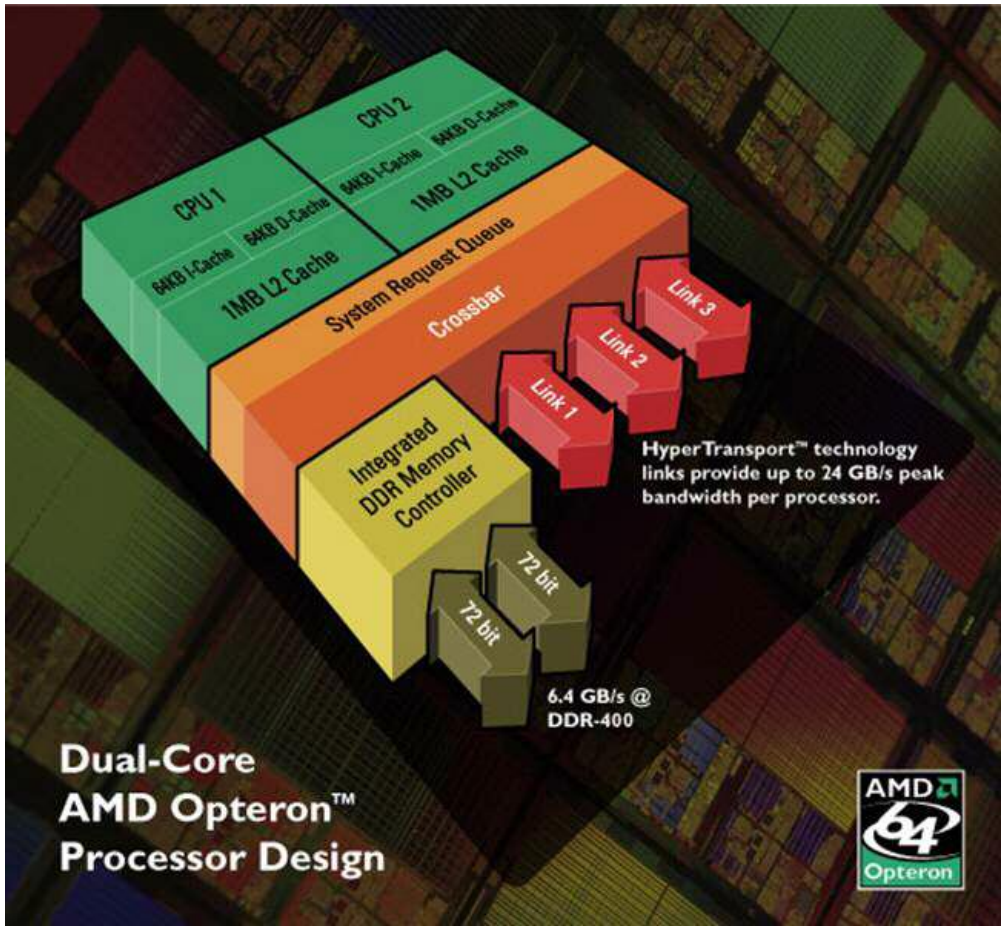
- "Platformization"
- Multiple chipsets for multiprocessors
- Disruptive architectures and roadmaps
- 20-year old front-side bus architecture

The Facts:

- Industry Standard AMD64 technology
- Direct Connect Architecture
- Cross-platform multi-core computing with infrastructure compatibility
- HyperTransport™ technology

Dual-Core AMD Opteron™ Architecture

- Designed for Dual Core
- 940-Pin Socket Compatible
- No Changes in Power
- Non-disruptive migration



Positioning Dual-Core

Highest performing AMD Opteron processor part

- Best performance for multi-threading and multi-tasking needs Period!!

Revolutionary Direct Connect Architecture

- Continued best approach of directly interconnecting CPU, memory, and I/O resources

Industry-leading performance

- Best Performance per watt architecture in the market

Cost-effective 940 socket infrastructure

- No disruptive upgrades

Best Performing 32-bit platform

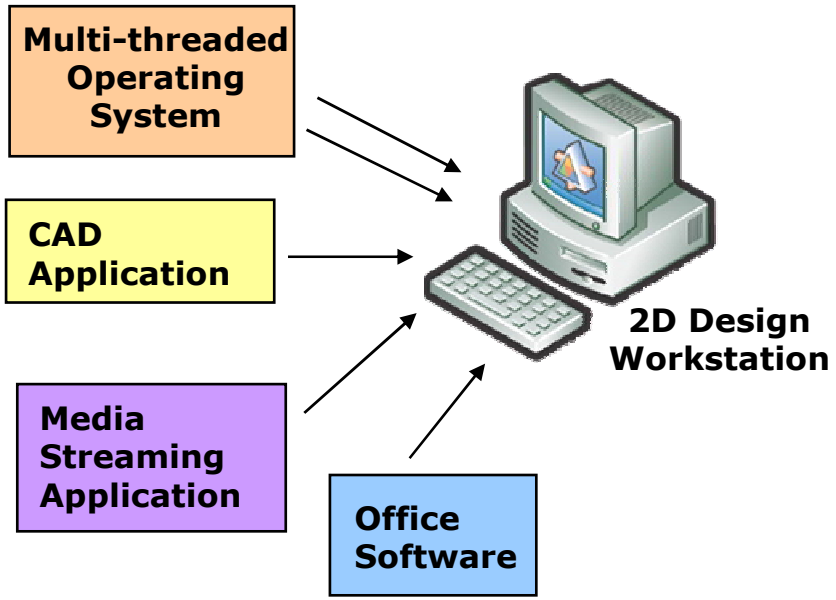
- Investment protection for best price/performance

Dual Core is not Hyper-Threading

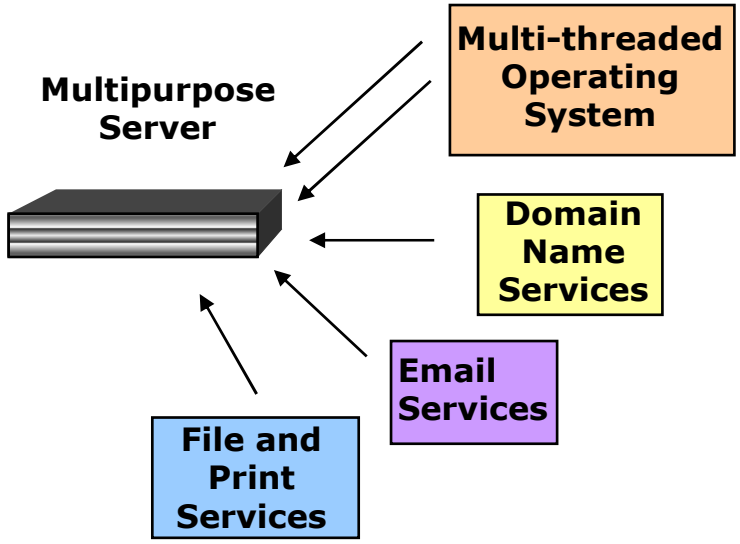
- Dual Core offers OS and applications physical cores for processing unlike virtual cores of Hyper-Threading
- With Hyper-Threading, a single processor appears to the OS as two "logical" processors – Intel's way of keeping the processor busy
- In Hyper-Threading mode, the CPU caches are divided between 'logical' CPU's – each one gets a smaller amount of cache – in AMD Dual Core, each physical core has its own dedicated cache
- Processors with Hyper-Threading still face the FSB bottlenecks, while AMD Dual Core is based on the Direct Connect Architecture
- Not all applications benefit from Hyper-Threading

Dual Core Is Ideal For Multitasking Needs

AMD64 Dual-Core Technology can improve system efficiency and application performance for computers running multiple applications at the same time



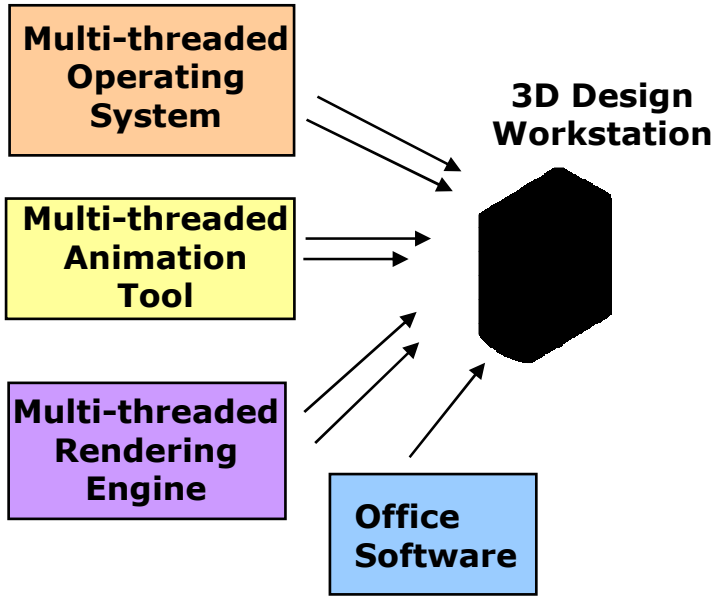
Workstation



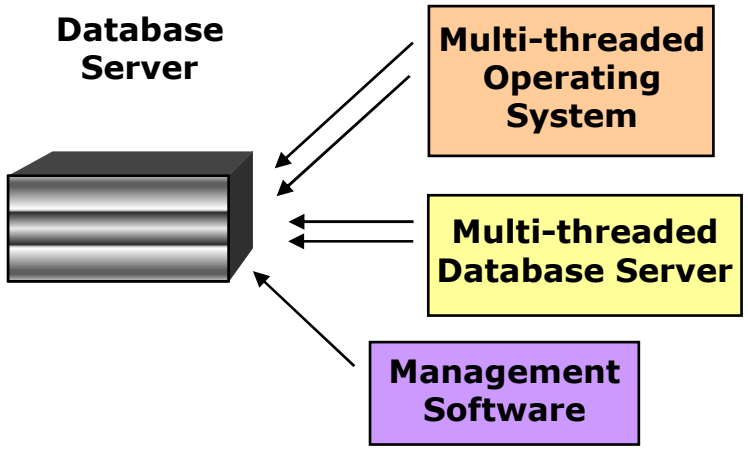
General Scalable Server

Multi-threaded OS and Applications

AMD64 Dual-Core Technology can improve system efficiency and application performance in multi-threaded environments

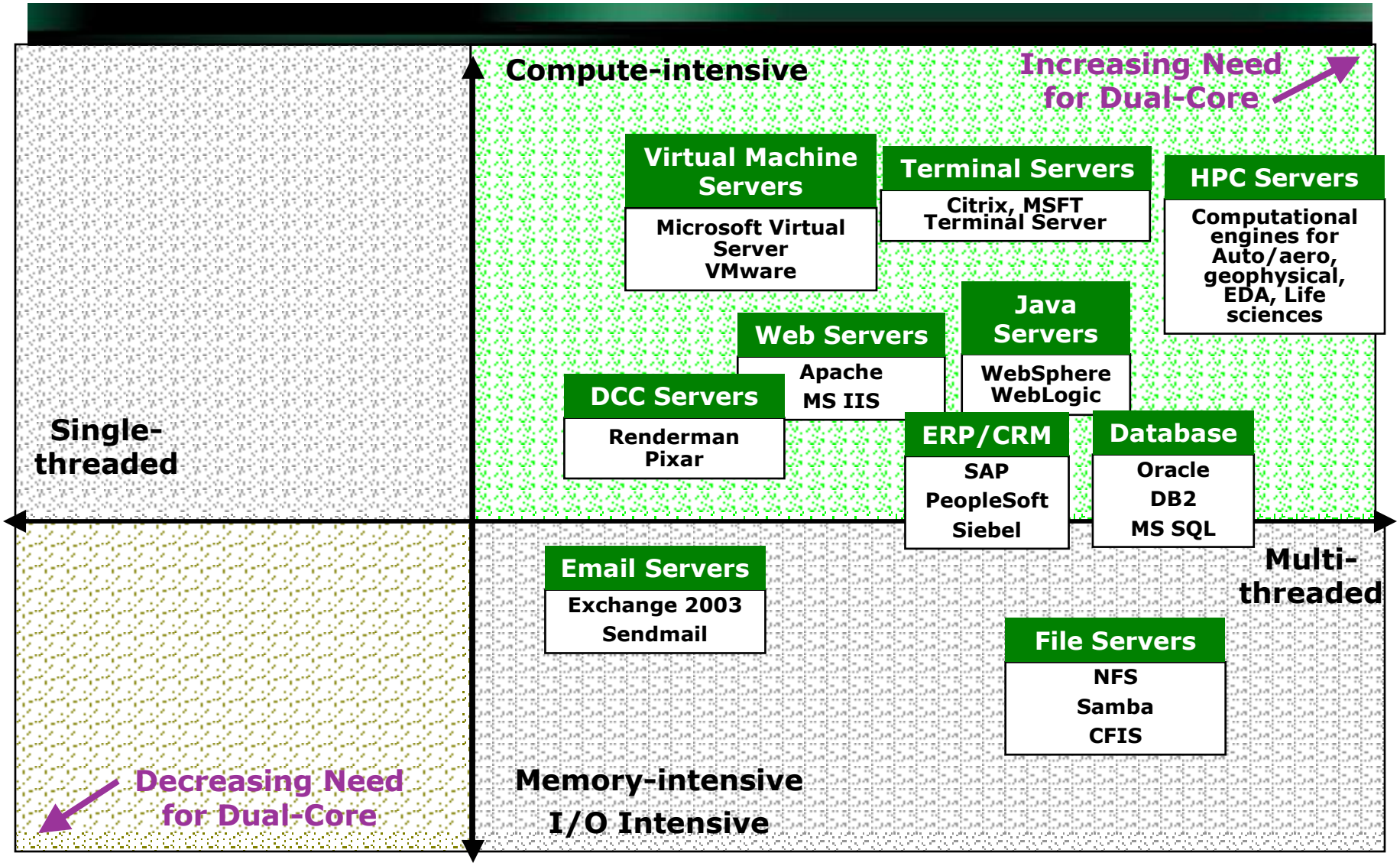


High-end Workstation

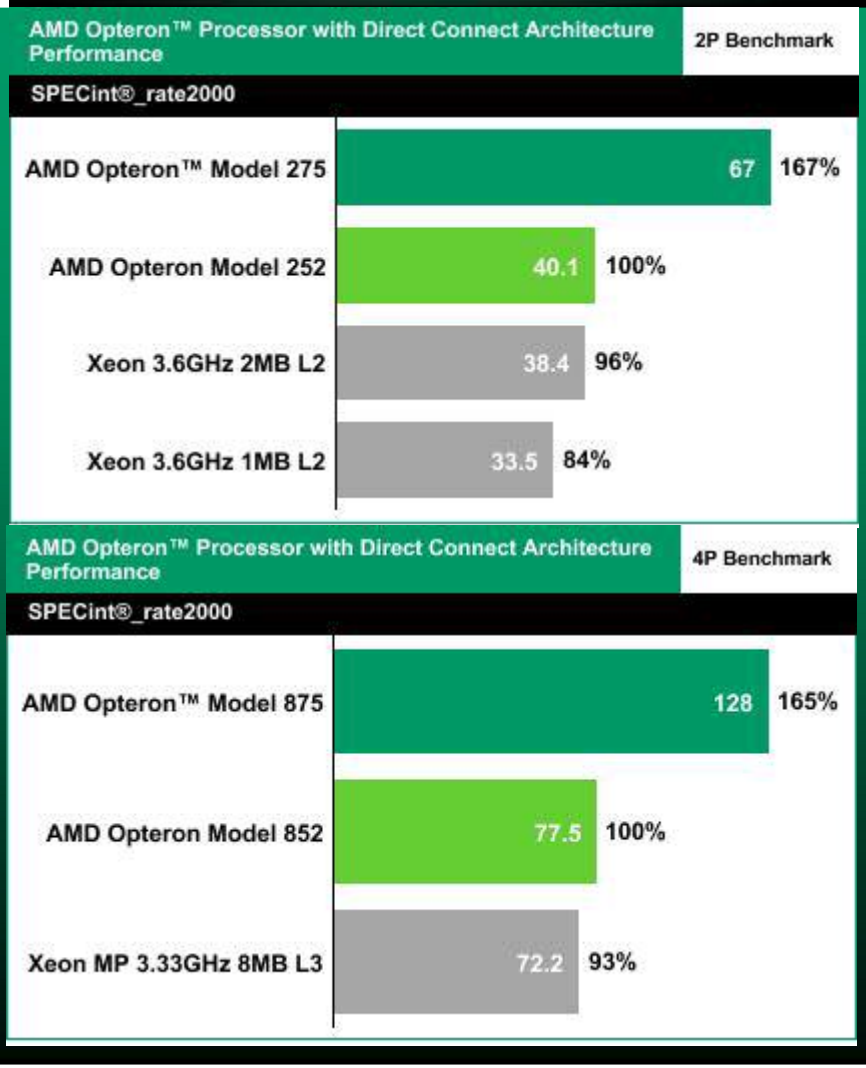


Mission Critical Server

Server Workload Positioning



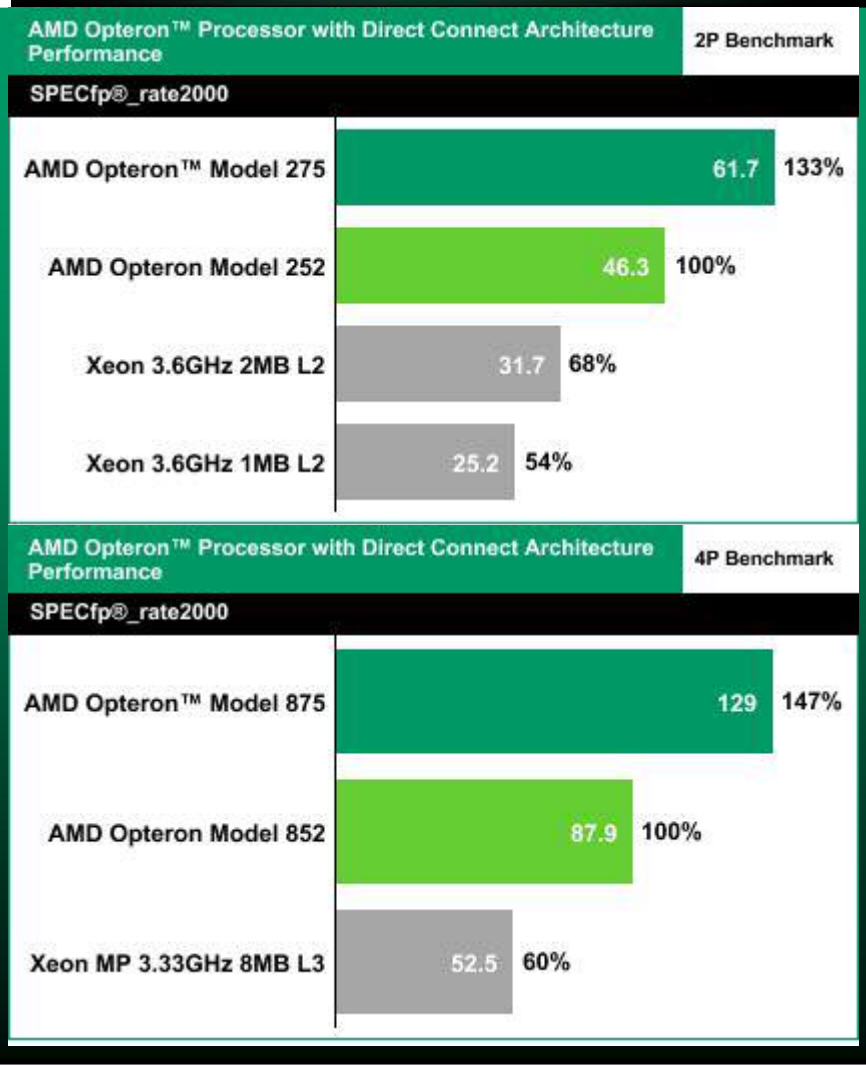
Compute-Intensive Applications
Example of Dual Core Performance



- For Integer-based applications (ex. web, database, file & print) HP Servers using Dual-Core AMD Opteron™ Processors with Direct Connect Architecture outperform Dell servers using Intel Xeon processors
  - Model 275 beats Xeon 3.6GHz "Irwindale" 2MB L2 by 74%
  - Model 875 beats Xeon MP 3.33GHz "Potomac" 8MB L3 by 77%

SPEC scores for systems based on AMD Opteron™ processors Model 275 and 875 are ESTIMATED

Compute-Intensive Applications
Example of Dual Core Performance



- For Floating-point-based applications (ex. scientific, engineering) HP Servers using Dual-Core AMD Opteron™ Processors with Direct Connect Architecture outperform Dell servers using Intel Xeon processors
  - Model 275 beats Xeon 3.6GHz "Irwindale" 2MB L2 by 95%
  - Model 875 beats Xeon MP 3.33GHz "Potomac" 8MB L3 by 146%!

SPEC scores for systems based on AMD Opteron™ processors Model 275 and 875 are ESTIMATED

Dual-Core AMD Opteron™ Processor: The Real Differentiator

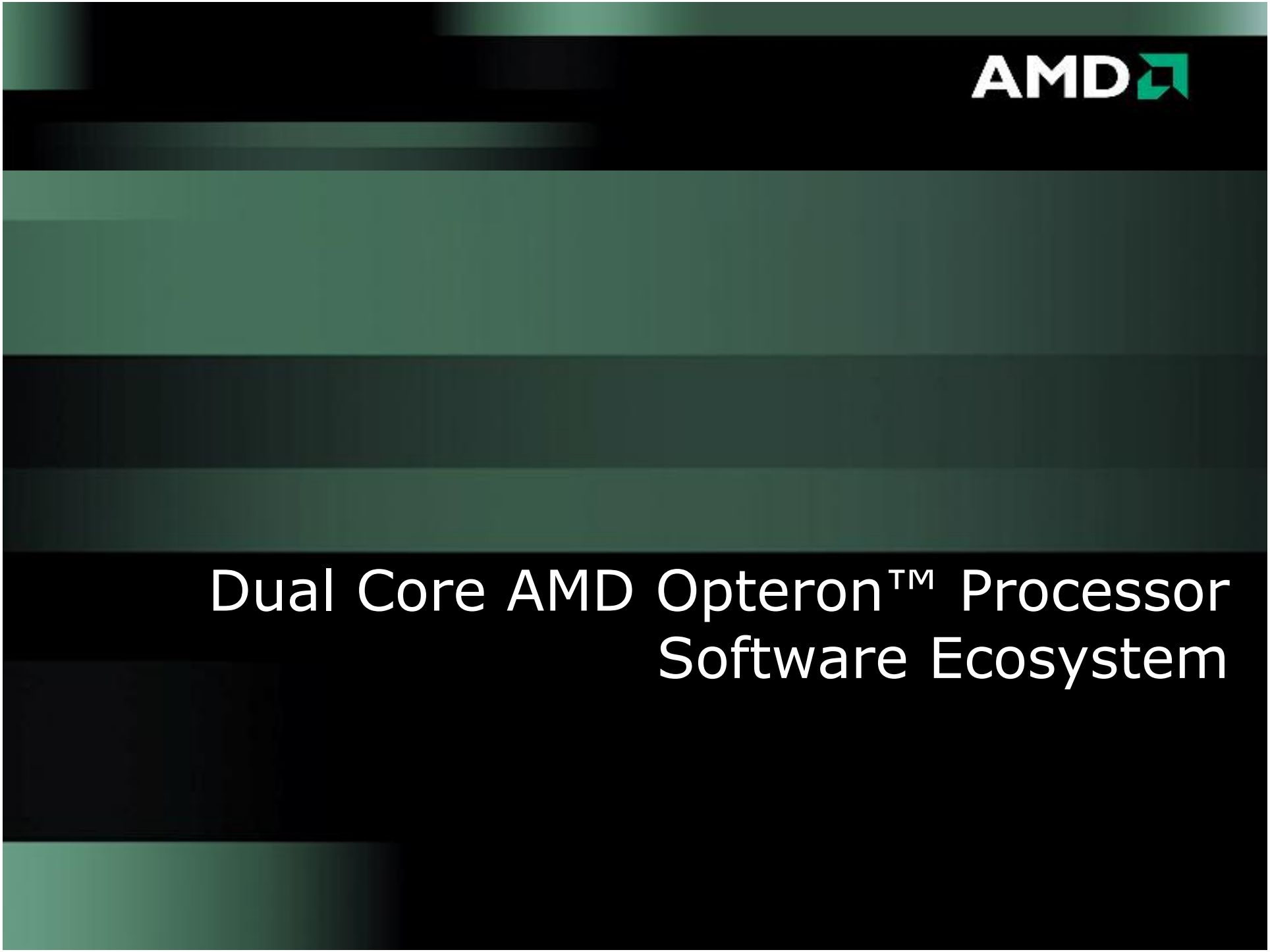
- Optimized system **performance** with Direct Connect Architecture
  - All multithreaded apps see higher performance
  - Directly connects I/O, memory and processors with open standard HyperTransport technology
  - Directly connects the two processor cores on to a single die for even greater reduced latencies between processors
- **Leading Performance** per **Watt** per **$$**
  - Fits within the same thermal envelope as single core
- **Stable** infrastructure
  - For an end user, same high performance socket and infrastructure across all 90nm AMD Opteron product
- Strong **Partner Support**
  - Leading systems manufacturers and software vendors support AMD64 Dual core technology
- **Execution** of strategy
  - First to market with X86 Dual-core server product

AMD Opteron™ Processor Dual Core Pricing Stack

Server Pricing Stack

- ***The AMD Opteron 800 Series – 4+ Socket***
  - Price performance advantage with equivalently performing competitive products
  - Seamless pricing migration to Dual Core
- ***The AMD Opteron 200 Series – 2 Socket***
  - Price performance parity with equivalently performing competitive products
  - Seamless pricing migration to Dual Core

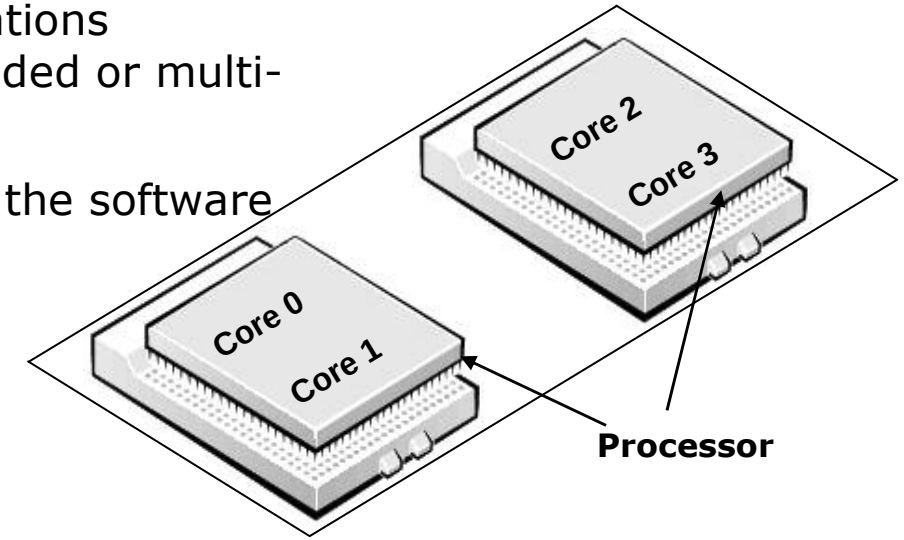
Processor	Price Stack at Dual Core launch
The AMD Opteron 800 Series	
AMD Opteron 875	**$2,649**
AMD Opteron 870	**$2,149**
AMD Opteron 865	**$1,514**
AMD Opteron 852	$1,514
AMD Opteron 850	$1,165
The AMD Opteron 200 Series	
AMD Opteron 275	**$1,299**
AMD Opteron 270	**$1,051**
AMD Opteron 265	**$851**
AMD Opteron 252	$851
AMD Opteron 250	$690


AMD
Dual Core AMD Opteron™ Processor
Software Ecosystem

Software Licensing Strategy

For the initial AMD64 dual core product releases, AMD is taking a leadership position in recommending that ISVs license by processor instead of by core.

- Only applies to software licensing methods that rely on processor count - there are many software licensing models that do not count processors today
- Ensures software compatibility with existing x86 32-bit and 64-bit operating systems and applications seamlessly whether they are single-threaded or multi-threaded applications.
- Higher performance **without** changes to the software
- AMD will continue competitive single core parts to meet customer's licensing needs for certain applications



Building the AMD64 Ecosystem

The AMD64 Software Ecosystem Continues to Grow!

- Thousands of x86-based applications run today on AMD64 processors
- AMD64 processors are driving major O/S ecosystems
  - Microsoft, Novell, Red Hat, Sun
- AMD64 technology is becoming a key component in software roadmaps
  - Windows® "Longhorn"
  - Virtualization software
- Access the AMD64 Ecosystem online to find the most up-to-date listing of 32- & 64-bit software that support AMD64 technology at **www.amd.com/amd64ecosystem**

AMD64 Ecosystem Web Site Apr. 2005 Statistics
Over 300 Development Organizations
Over 1,300 packages certified for AMD64 over 1,150 are shipping
120 operating system (versions) Includes Linux, Solaris, UNIX, Windows® 52 are 64-bit (32 shipping)
307 Development Tools (versions) 115 are 64-bit (87 shipping)
52 Database Engines (versions) 19 are 64-bit (13 shipping)
385 Infrastructure Applications 101 are 64-bit (76 shipping)
470 Vertical Applications 171 are 64-bit (114 shipping)


AMD
Back-up
Additional Resources

Benchmark Configurations
Backup

AMD Opteron™ Processor Performance
2P System Configurations

SPECint®_rate2000

1. 2 AMD Opteron™ processors Model 875 with 2 x 1MB L2 cache in HP DL585, Microsoft® Windows® Server 2003 Enterprise Edition.
2. 2 AMD Opteron™ processors Model 852 with 1MB L2 cache in HP DL585, Microsoft® Windows® Server 2003 Enterprise Edition.
3. 2 Xeon 3.6GHz processors with 2MB L2 cache in Dell PowerEdge SC1425, Windows 2003 Server, Standard Edition.
   http://www.spec.org/cpu2000/results/res2005q1/cpu2000-20050207-03788.html
4. 2 x Xeon 3.6GHz processors with 1MB L2 cache in Dell PowerEdge SC1425 server, Microsoft® Windows® Server 2003 Standard Edition.
   http://www.spec.org/osg/cpu2000/results/res2004q4/cpu2000-20041101-03492.html

SPECfp®_rate2000

1. 2 AMD Opteron™ processors Model 275 with 2 x 1MB L2 cache in HP DL585, Microsoft® Windows® Server 2003 Enterprise Edition
2. 2 AMD Opteron™ processors Model 252 with 1MB L2 cache in HP DL585, Microsoft® Windows® Server 2003 Enterprise Edition
3. 2 Xeon 3.6GHz processors with 2MB L2 cache in Dell PowerEdge 1425SC, Windows Server 2003, Standard Edition.
   http://www.spec.org/cpu2000/results/res2005q1/cpu2000-20050207-03789.html
4. 2 Xeon 3.6GHz processors with 1MB L2 cache in Dell PowerEdge 1425SC, Windows Server 2003, Standard Edition.
   http://www.spec.org/osg/cpu2000/results/res2004q4/cpu2000-20041101-03493.html

AMD Opteron™ Processor Performance
4P System Configurations

SPECint®_rate2000

1. 4 AMD Opteron™ processors Model 875 with 2 x 1MB L2 cache in HP DL585, Microsoft® Windows® Server 2003 Enterprise Edition.
2. 4 AMD Opteron™ processors Model 852 in HP DL585 Server, Microsoft Windows Server 2003 Enterprise Edition.
3. 4xIntel® Xeon™ Processor MP 3.33GHz with 8MB L3 Cache in Dell PowerEdge 6850, Windows Server 2003 Enterprise Edition.

   http://www.spec.org/osg/cpu2000/results/res2005q2/cpu2000-20050321-03933.html

SPECfp®_rate2000

1. 4 AMD Opteron™ processors Model 875 with 2 x 1MB L2 cache in 4P Server, 16GB memory, 1 x 74GB SCSI hard disk, Microsoft® Windows® Server 2003 Enterprise Edition.
2. 4 AMD Opteron™ processors Model 852 in 4P Server, Microsoft® Windows® Server 2003 Enterprise Edition.
3. 4 Intel® Xeon™ Processor MP 3.33GHz with 8MB L3 Cache in Dell PowerEdge 6850, Microsoft Windows Server 2003 Enterprise Edition.

   http://www.spec.org/osg/cpu2000/results/res2005q2/cpu2000-20050321-03934.html

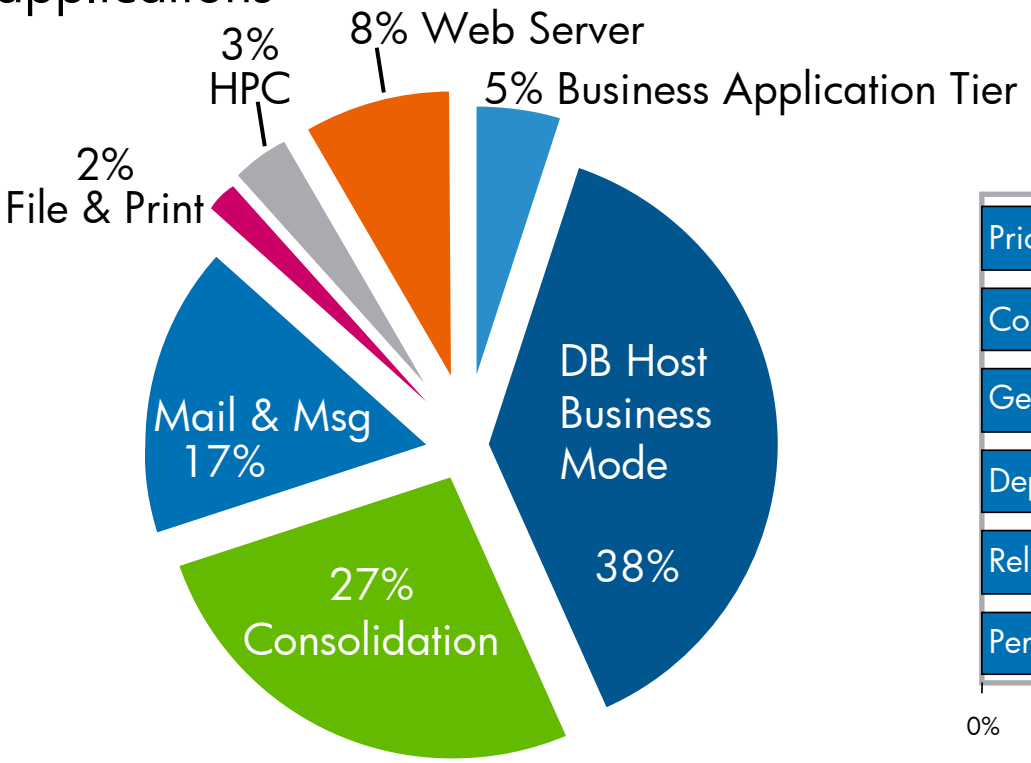
Trademark Attribution

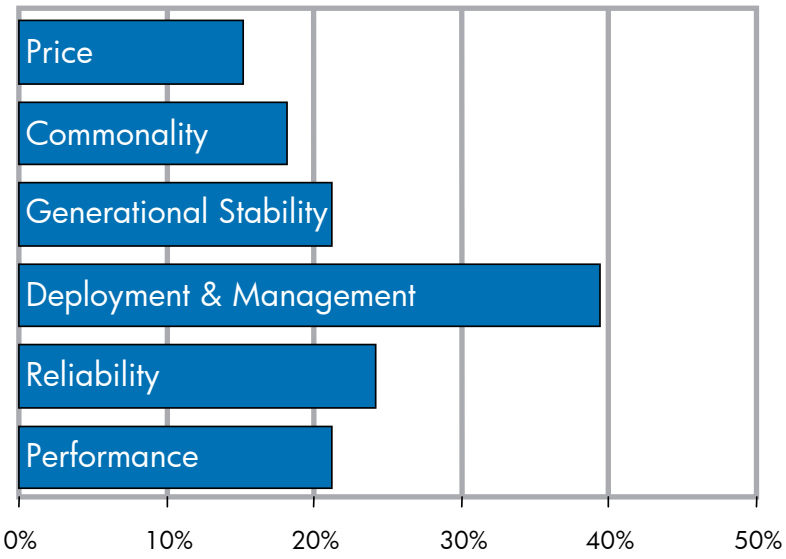
HP ProLiant Dual-Core

Steve Cumings
Group Manager,
ISS Server Platforms Marketing
Industry Standard Servers

Where 4P servers are being used

87% of 4P deployments are planned to be on performance-driven applications

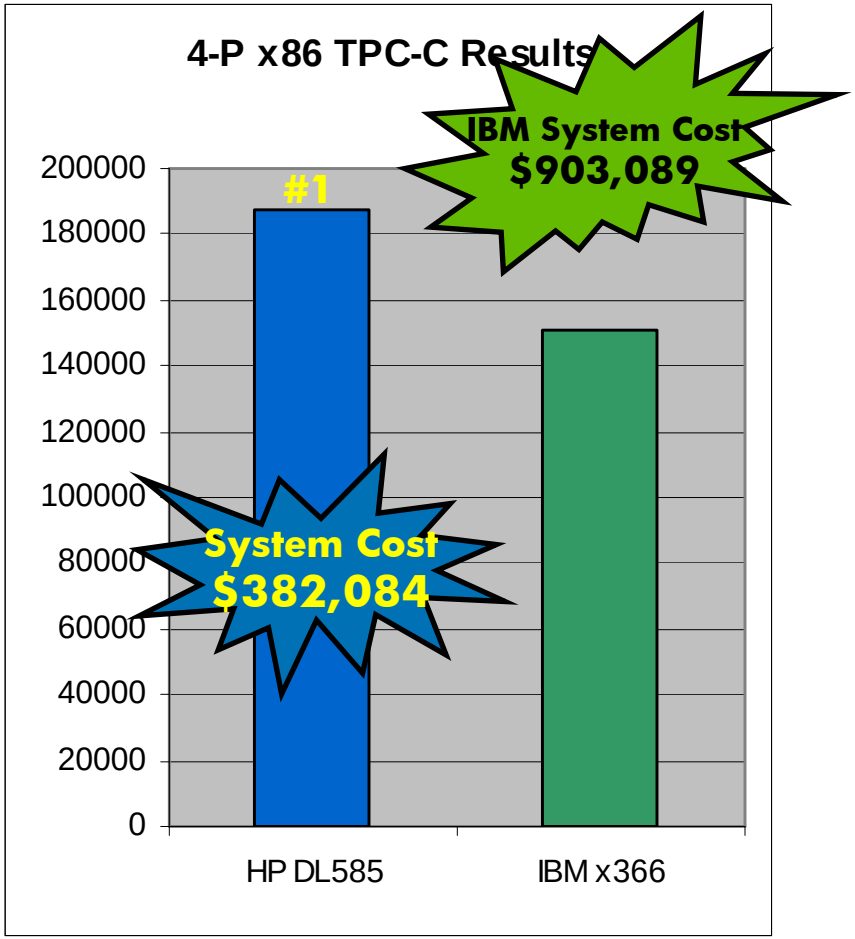




Dual Core x86 Value to the Industry

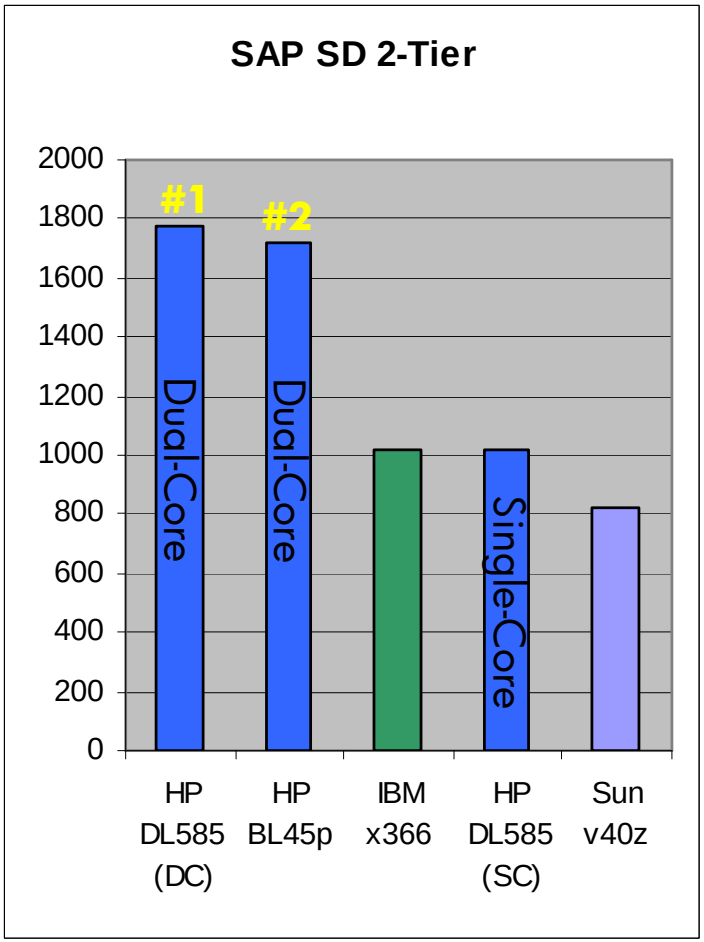
- **Dual Core delivers a major change in x86 server functionality**
  - Same watts, same footprint
  - More capacity – much higher performance & price:performance
- **Huge consolidation opportunity**
  - 32-bit and 64-bit apps on same system at full speed
  - Dual Core plus HP VMM provides major performance and functionality increase for Virtualization
- **MP Apps**
  - x86-64 dual-core servers deliver higher workload support for almost any application
- **8-way redefined**
  - Delivery of dual-core, and the scalability of Opteron and the DL585 provide performance beyond current x86 8P servers

HP – 4-Processor x86 Performance Leader!



25% Faster at just over 1/3rd the cost!

Note: HP DL585: 187296tpmC @ $2.04/tpmC IBM x366: 150704tpmC @ $5.99/tpmC As of April 27, 2005 – www.tpc.org



Two-tier SAP Sales and Distribution Standard Application Benchmark
More info. can be found at www.sap.com/benchmark
As of 4.21.05

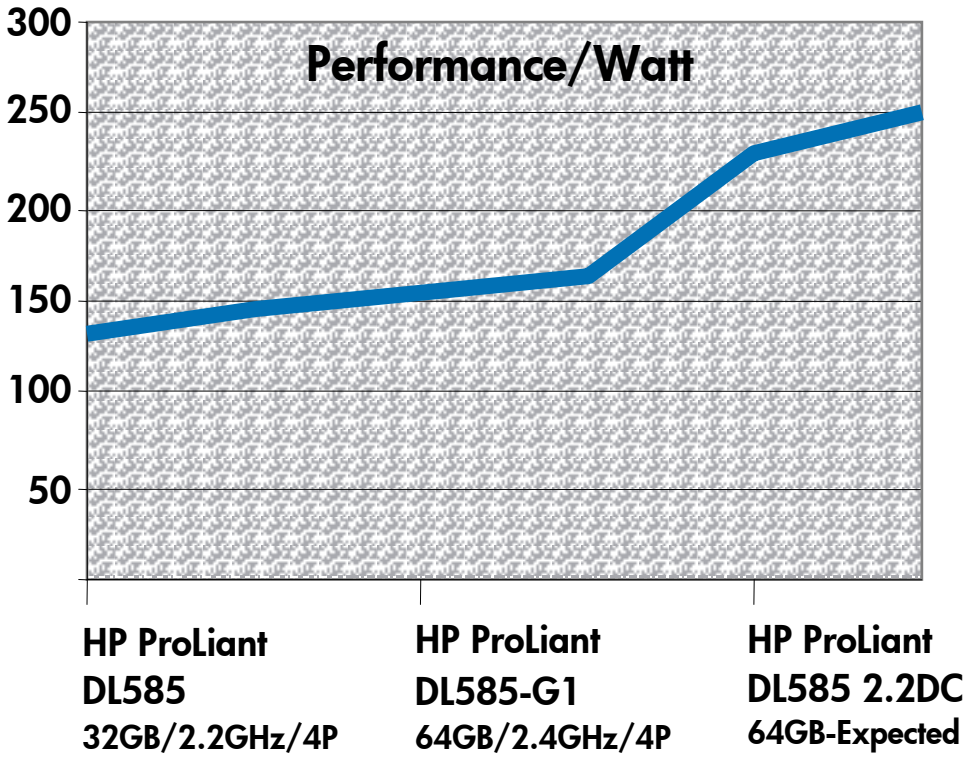
HP Dual Core AMD Opteron-based Servers: More Performance/Watt

[redacted]

Nearly 2X performance for the same power

Saves on blade and Infrastructure costs

Huge performance increase without power penalty



Customer Reaction

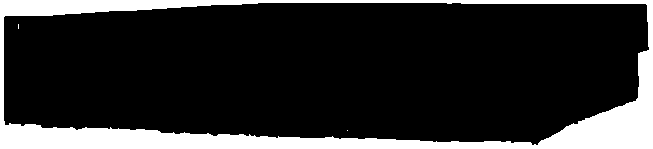
"The benefits that we've seen in the DL585, specifically with respect to absolute performance, performance per watt and price-to-performance are tremendous." **Ed Leonard, chief technology officer, DreamWorks Animation SKG.**

"The price-to-performance benefits of the AMD Opteron™ processor-based HP DL585 servers we installed at Sabre last year have exceeded our expectations… Now with the Dual-Core AMD Opteron processors, we have seen even greater performance and stability, exceeding our expectations once again." **Alan Walker, Vice President, Sabre Holdings**

"With the new Dual-Core AMD Opteron™ processor-based HP ProLiant DL585 servers, our systems' performance is increasing exponentially…" **Stephen Smith, Manager, Solutions Integrations and Automation, Starz Entertainment Group**

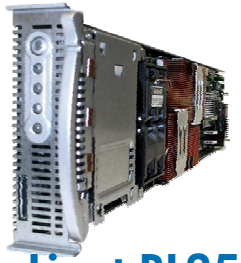
HP ProLiant AMD Opteron-based Portfolio

HP ProLiant DL585

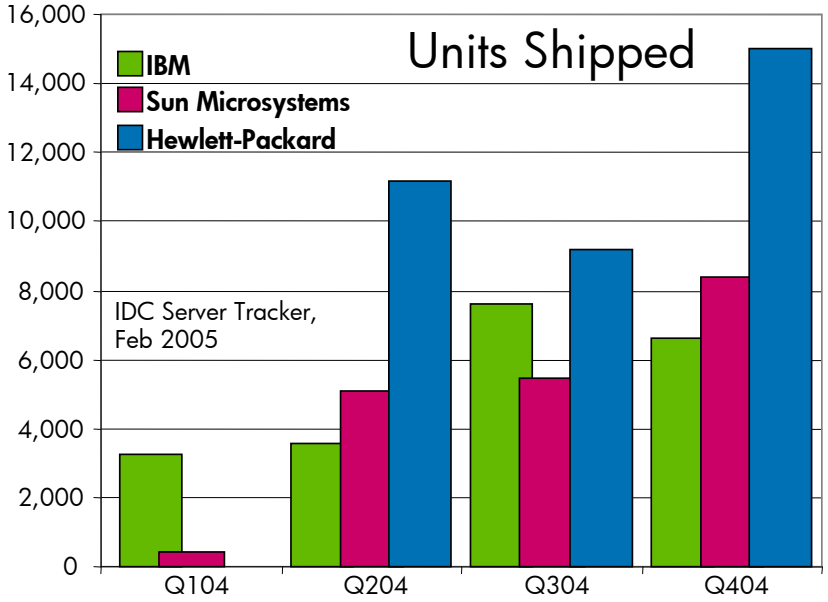


HP ProLiant DL385

HP ProLiant DL145



HP ProLiant BL35p



HP ProLiant BL45p

HP ProLiant BL25p

HP workstation xw9300

HP and Dual-Core

Maximum Performance

The ProLiant DL585 continues to break performance records – and we're just getting started!

Server Consolidation

Systems designed with high-bandwidth I/O subsystems and memory footprints for VM environments. VMM provides the management configuring and managing the growth in virtual machines enabled by dual-core processors

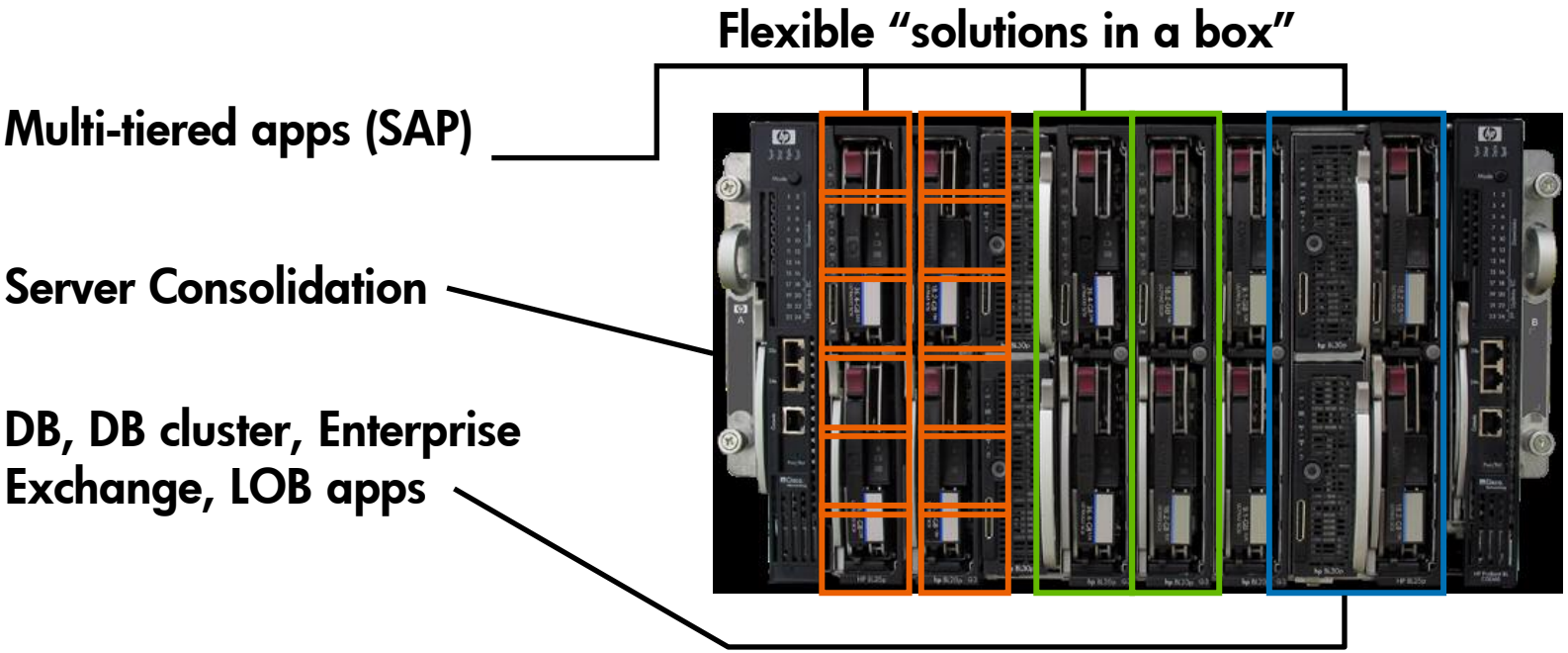
Multi-tiered Apps (SAP)

Opteron dual-core in BL45p, BL25p and BL35p allows multi-tiered apps such as SAP to be consolidated within a single blade enclosure. ProLiant DL585 is a power workhorse for databases and large apps.

Portfolio:

With a full portfolio of products designed to take advantage of Opteron dual-core performance, HP is delivering the right platform for the right application, including: DB, DB cluster, Enterprise Exchange, and LOB apps

New 4P Server Blade enables simplified infrastructure solutions

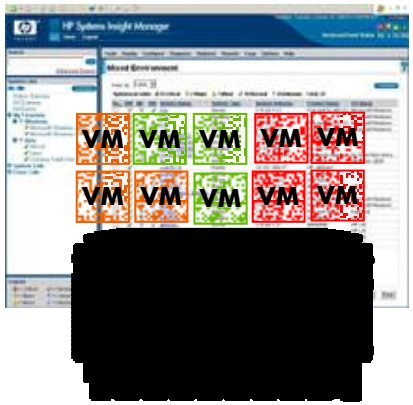


BladeSystem infrastructure + HP management enable the Adaptive Enterprise

- HP SIM and BladeSystem Management Suite
- HP Virtual Machine Manager
- Leading Partners: VMWare and PolyServe

HP offers the best platforms for Virtual Machine Management

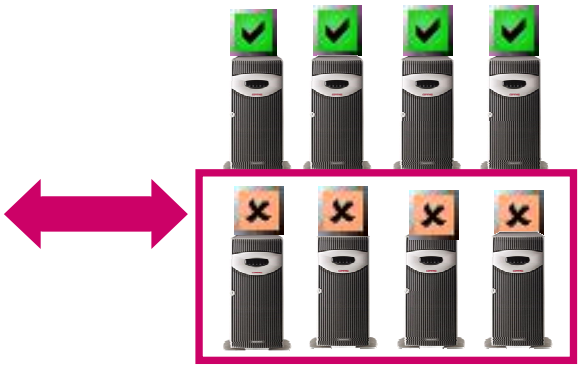
Lower administration costs



Performance
Modularity
Reliability
Automated

- Linux or Windows
- VMware or MS
- VPARs in future

Easiest path to production



Single console:
Unified management of VMs and host servers

Heterogeneous VM control:
Manage and move heterogeneous VMs for customer choice and flexibility

Physical to Virtual:
Target existing, low utilization servers for rapid, easy consolidation

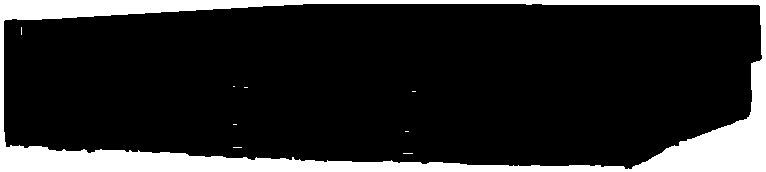
HP Delivering Dual-Core

- HP has #1 market share: Opteron-based server volume, & overall x86 server volume (IDC Server Tracker)

- HP has delivered the broadest portfolio of Opteron-based servers
  - **DL585** – Industry-leading performance, market volume leader
  - **BL45p** – Density AND leading blade performance
  - **DL385** – Ramping faster than any HP Opteron server
  - **DL145** – 2P/1U Opteron volume leader (IDC)
  - **BL25p** – Performance and density
  - **BL35p** – Performance and MAX density

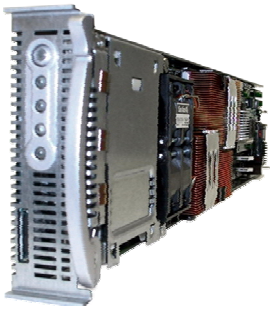
- All systems are designed to enable dual-core

HP – Delivering Choice



HP ProLiant DL385

HP ProLiant DL585



HP ProLiant BL35p

HP ProLiant DL145

HP ProLiant BL45p

HP ProLiant BL25p


invent

SAP Benchmark Data

Server	Certification Number	SD Users / Line Items per hr	Cache	OS/DBSoftware
ProLiant DL585 AMD Opteron 875, 2.2GHz, 32GB RAM	2005017	1,772/ 178,000	128 KB L1,1 MB L2	MS Windows Server 2003 EE (64-bit) and MS SQL Server 2000 EE (32-bit).SAP R/3 Enterprise 4.70 (64-bit)
ProLiant BL45p, AMD Opteron 875, 2.2GHz, 32GB RAM	2005018	1,716/ 172,000	128 KB L1,1 MB L2	MS Windows Server 2003 EE (64-bit), MS SQL Server 2000 (32–bit) SAP R/3 Enterprise 4.70 (64-bit)
IBM eServer xSeries 366, Intel XEON MP 3.66GHz, 32GB RAM	2005016	1020/ 102330	L1 Execution Trace,1MB L2	MS Windows Server 2003 EE (64-bit) and DB2 UDB 8.2 (64-bit), SAP R/3 Enterprise 4.70 (64-bit)
ProLiant DL585 AMD Opteron 852, 2.6GHz, 16GB RAM	2005004	1,017/ 102,000	128 KB L1,1 MB L2	MS Windows Server 2003 EE (64-bit) and MS SQL Server 2000 EE (32-bit). SAP R/3 Enterprise 4.70 (64-bit)
Sun V40z Model 820, AMD Opteron 850 series, 2.4GHz	2004044	820/ 82,330	1MB L2	SuSE Linux Enterprise Server 8 (64-bit), Oracle 9i (32-bit), SAP R/3 Enterprise 4.70 (32-bit)

Q & A Panel

Michael Kreiger
VP, Market Experts Group
Ziff Davis Media

Steve Cumings
Group Manager,
ISS Server Platforms
Marketing Industry
Standard Servers
HP

Patrick Patla
Director,
Server and Workstation
Business Segment
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