Quad-Core AMD Opteron™ Processor with Direct Connect Architecture

4P Server and Workstation Architecture Comparison

**Quad-Core AMD Opteron™ Processor-Based 4P Server**

- Direct Connect Architecture
  - Silicone-assisted Virtualization (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
  - Rapid Virtualization Indexing is designed to improve performance on memory-intensive applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
  - Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
  - Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Optimal Virtualization**
- Silicon-assisted AMD Virtualization™ (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
- Rapid Virtualization Indexing is designed to improve performance on many virtualized applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
- Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
- Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Industry-Leading Performance-Per-Watt**
- Highly efficient computing cores with Enhanced AMD PowerNow!™ technology can reduce CPU power consumption to match application needs, helping reduce power consumption without compromising performance.
- AMD CoolCore™ technology reduces power to unused sections of the CPU to help save power and cooling costs.
- Dynamic Power Management™ helps maximize the power saving capabilities of AMD PowerNow!™ technology while maintaining memory throughput for superior application performance.
- Uses low-power, high-bandwidth DDR2 memory for excellent performance and greater efficiency than competing memory technologies.

**Balanced Performance With AMD Direct Connect Architecture**
- AMD64 technology enables simultaneous high-performance on 64-bit and 32-bit applications.
- Addresses and helps reduce the real challenges and bottlenecks of traditional front-side bus architectures by directly connecting the processors, memory, and I/O.
- Integrated DDR2 memory controller: Low-latency, high-bandwidth interface enables high performance on memory-intensive applications while the performance is designed to provide enterprise class reliability for your datacenter.
- HyperTransport™ technology links: At up to 8GB/s bandwidth per link, with up to 3 links per processor connecting CPUs-to-CPU, CPUs-to-I/O, provides bandwidth and scalability for supporting I/O intensive server and workstation applications.
- AMD Balanced Smart Cache and AMD Memory Optimizer Technology are designed for exceptional performance on highly-threaded applications and multi-tasking environments.

**Direct Connect Architecture**

**Optimal Virtualization**
- Silicon-assisted AMD Virtualization™ (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
- Rapid Virtualization Indexing is designed to improve performance on memory-intensive applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
- Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
- Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Industry-Leading Performance-Per-Watt**
- Highly efficient computing cores with Enhanced AMD PowerNow!™ technology can reduce CPU power consumption to match application needs, helping reduce power consumption without compromising performance.
- AMD CoolCore™ technology reduces power to unused sections of the CPU to help save power and cooling costs.
- Dynamic Power Management™ helps maximize the power saving capabilities of AMD PowerNow!™ technology while maintaining memory throughput for superior application performance.
- Uses low-power, high-bandwidth DDR2 memory for excellent performance and greater efficiency than competing memory technologies.

**Balanced Performance With AMD Direct Connect Architecture**
- AMD64 technology enables simultaneous high-performance on 64-bit and 32-bit applications.
- Addresses and helps reduce the real challenges and bottlenecks of traditional front-side bus architectures by directly connecting the processors, memory, and I/O.
- Integrated DDR2 memory controller: Low-latency, high-bandwidth interface enables high performance on memory-intensive applications while the performance is designed to provide enterprise class reliability for your datacenter.
- HyperTransport™ technology links: At up to 8GB/s bandwidth per link, with up to 3 links per processor connecting CPUs-to-CPU, CPUs-to-I/O, provides bandwidth and scalability for supporting I/O intensive server and workstation applications.
- AMD Balanced Smart Cache and AMD Memory Optimizer Technology are designed for exceptional performance on highly-threaded applications and multi-tasking environments.

**Six-Core Intel Xeon Processor-Based System**

- Memory capacity scales with numbers of processors.
- HyperTransport™ technology buses enable glueless expansion for up to 8-way servers.
- Memory capacity scales with numbers of processors.

**Optimal Virtualization**
- Silicon-assisted AMD Virtualization™ (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
- Rapid Virtualization Indexing is designed to improve performance on memory-intensive applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
- Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
- Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Industry-Leading Performance-Per-Watt**
- Highly efficient computing cores with Enhanced AMD PowerNow!™ technology can reduce CPU power consumption to match application needs, helping reduce power consumption without compromising performance.
- AMD CoolCore™ technology reduces power to unused sections of the CPU to help save power and cooling costs.
- Dynamic Power Management™ helps maximize the power saving capabilities of AMD PowerNow!™ technology while maintaining memory throughput for superior application performance.
- Uses low-power, high-bandwidth DDR2 memory for excellent performance and greater efficiency than competing memory technologies.

**Balanced Performance With AMD Direct Connect Architecture**
- AMD64 technology enables simultaneous high-performance on 64-bit and 32-bit applications.
- Addresses and helps reduce the real challenges and bottlenecks of traditional front-side bus architectures by directly connecting the processors, memory, and I/O.
- Integrated DDR2 memory controller: Low-latency, high-bandwidth interface enables high performance on memory-intensive applications while the performance is designed to provide enterprise class reliability for your datacenter.
- HyperTransport™ technology links: At up to 8GB/s bandwidth per link, with up to 3 links per processor connecting CPUs-to-CPU, CPUs-to-I/O, provides bandwidth and scalability for supporting I/O intensive server and workstation applications.
- AMD Balanced Smart Cache and AMD Memory Optimizer Technology are designed for exceptional performance on highly-threaded applications and multi-tasking environments.

**Direct Connect Architecture**

**Optimal Virtualization**
- Silicon-assisted AMD Virtualization™ (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
- Rapid Virtualization Indexing is designed to improve performance on memory-intensive applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
- Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
- Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Industry-Leading Performance-Per-Watt**
- Highly efficient computing cores with Enhanced AMD PowerNow!™ technology can reduce CPU power consumption to match application needs, helping reduce power consumption without compromising performance.
- AMD CoolCore™ technology reduces power to unused sections of the CPU to help save power and cooling costs.
- Dynamic Power Management™ helps maximize the power saving capabilities of AMD PowerNow!™ technology while maintaining memory throughput for superior application performance.
- Uses low-power, high-bandwidth DDR2 memory for excellent performance and greater efficiency than competing memory technologies.

**Balanced Performance With AMD Direct Connect Architecture**
- AMD64 technology enables simultaneous high-performance on 64-bit and 32-bit applications.
- Addresses and helps reduce the real challenges and bottlenecks of traditional front-side bus architectures by directly connecting the processors, memory, and I/O.
- Integrated DDR2 memory controller: Low-latency, high-bandwidth interface enables high performance on memory-intensive applications while the performance is designed to provide enterprise class reliability for your datacenter.
- HyperTransport™ technology links: At up to 8GB/s bandwidth per link, with up to 3 links per processor connecting CPUs-to-CPU, CPUs-to-I/O, provides bandwidth and scalability for supporting I/O intensive server and workstation applications.
- AMD Balanced Smart Cache and AMD Memory Optimizer Technology are designed for exceptional performance on highly-threaded applications and multi-tasking environments.

**Direct Connect Architecture**

**Optimal Virtualization**
- Silicon-assisted AMD Virtualization™ (AMD-V®) with Rapid Virtualization Indexing offers leading-edge performance, security, and application support.
- Rapid Virtualization Indexing is designed to improve performance on memory-intensive applications by enabling memory management in hardware, allowing for a higher-performing, more flexible environment.
- Direct Connect Architecture for excellent scalability and performance on I/O and memory-intensive virtualized application environments; enabling more virtual machines to run per server.
- Integrated memory controller offers leading-edge x86 capabilities, helping improve performance while efficiently enforcing security between virtual machines.

**Industry-Leading Performance-Per-Watt**
- Highly efficient computing cores with Enhanced AMD PowerNow!™ technology can reduce CPU power consumption to match application needs, helping reduce power consumption without compromising performance.
- AMD CoolCore™ technology reduces power to unused sections of the CPU to help save power and cooling costs.
- Dynamic Power Management™ helps maximize the power saving capabilities of AMD PowerNow!™ technology while maintaining memory throughput for superior application performance.
- Uses low-power, high-bandwidth DDR2 memory for excellent performance and greater efficiency than competing memory technologies.

**Balanced Performance With AMD Direct Connect Architecture**
- AMD64 technology enables simultaneous high-performance on 64-bit and 32-bit applications.
- Addresses and helps reduce the real challenges and bottlenecks of traditional front-side bus architectures by directly connecting the processors, memory, and I/O.
- Integrated DDR2 memory controller: Low-latency, high-bandwidth interface enables high performance on memory-intensive applications while the performance is designed to provide enterprise class reliability for your datacenter.
- HyperTransport™ technology links: At up to 8GB/s bandwidth per link, with up to 3 links per processor connecting CPUs-to-CPU, CPUs-to-I/O, provides bandwidth and scalability for supporting I/O intensive server and workstation applications.
- AMD Balanced Smart Cache and AMD Memory Optimizer Technology are designed for exceptional performance on highly-threaded applications and multi-tasking environments.
## QUAD-CORE AMD OPTERON™ PROCESSOR-BASED 4P SERVER WITH DIRECT CONNECT ARCHITECTURE

<table>
<thead>
<tr>
<th>SERVER SYSTEM COMPARISON</th>
<th>QUAD-CORE AMD OPTERON™ PROCESSOR (45nm)</th>
<th>SIX-CORE INTEL XEON MP 7400 SERIES 1,2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modular, glueless scalability</td>
<td>Yes</td>
<td>Requires Northbridge</td>
</tr>
<tr>
<td>SMP Capabilities</td>
<td>Up to 8 sockets / 32 cores</td>
<td>Up to 4 sockets / 24 cores</td>
</tr>
<tr>
<td>Direct Connect Architecture</td>
<td>Yes</td>
<td>No – uses front side bus</td>
</tr>
<tr>
<td>High-Performance 32-bit and 64-bit computing</td>
<td>AMD64</td>
<td>EM64T</td>
</tr>
<tr>
<td>HyperTransport™ technology</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Integrated DDR2 memory controller</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Hardware-Assisted Virtualization</td>
<td>AMD-V™, with Rapid Virtualization Indexing</td>
<td>Intel VT</td>
</tr>
<tr>
<td>Memory support</td>
<td>RDDR2 400/533/667/800</td>
<td>FBDIMM 533/667</td>
</tr>
<tr>
<td>Memory Bandwidth 4P System</td>
<td>51.2GB/s</td>
<td>32GB/s</td>
</tr>
<tr>
<td>Maximum I/O bandwidth with 4P System</td>
<td>32.0GB/s</td>
<td>6GB/s</td>
</tr>
<tr>
<td>L1 cache size (max)</td>
<td>64KB (Data) + 64KB (Instruction) per core</td>
<td>32KB (Data) + 32KB (Instruction) per core</td>
</tr>
<tr>
<td>L2 cache size (max)</td>
<td>512KB per core</td>
<td>8-9MB shared (3MB per 2 cores)</td>
</tr>
<tr>
<td>L3 cache size (max)</td>
<td>6MB (shared, exclusive)</td>
<td>B-16MB (shared, inclusive)</td>
</tr>
<tr>
<td>SIMD Instruction Set Support</td>
<td>SSE, SSE2, SSE3, SSE4A</td>
<td>SSE2, SSE3, SSE4</td>
</tr>
</tbody>
</table>

1. AMD 4P System — AMD Opteron™ processor 8000 Series with 4 HyperTransport™ technology Inter-processor Buses and 4 HyperTransport™ technology I/O Buses with DDR2-800 memory
2. With Intel 7300 and 7200 Chipset (http://download.intel.com/design/chipsets/datashts/318082.pdf)
3. Other OEM chipsets support additional capabilities

### TECHNICAL SUPPORT

USA & CANADA: 800-222-9525 OR 408-749-5703
USA & CANADA PC MICROPROCESSOR: 408-749-3060
USA & CANADA EMAIL: HW.SUPPORT@AMD.COM
LATIN AMERICA EMAIL: AMDXSBRPO@VSR.AMD.BR
EUROPE & UK: +44-0-1276-803299
EUROPE & UK FAX: +44-0-1276-803298
FRANCE: 0800-908-621
GERMANY: +49-99-450-5399
ITALY: 800-877224
EUROPE EMAIL: EURO.TECH@AMD.COM
FAR EAST FAX: 852-2956-0588
JAPAN FAX: 03-3349-784

©2008 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD Arrow logo, AMD Opteron, AMD PowerNow!, AMD CoolCore, Dual Dynamic Power Management, AMD-8132, AMD Virtualization, AMD-V, and combinations thereof are trademarks of Advanced Micro Devices, Inc. HyperTransport is a licensed trademark of the HyperTransport Technology Consortium. Other names are for informational purposes only and may be trademarks of their respective owners.