

AMD EPYC SoC Sets 4 World Records on SPEC CPU Benchmarks



Up to 59% better floating-point performance on 2-socket servers

PERFORMANCE BRIEF
JUNE 2017

HIGHLIGHTS

- **UP TO 25% BETTER INTEGER PERFORMANCE⁷ ON THE SPECINT[®]_RATE2006 BENCHMARK FOR 2-SOCKET SERVERS COMPARED TO THE INTEL XEON PROCESSOR E5-2699A V4**
- **UP TO 59% BETTER FLOATING POINT PERFORMANCE⁶ ON THE SPECFP[®]_RATE2006 BENCHMARK FOR 2-SOCKET SERVERS COMPARED TO THE INTEL XEON PROCESSOR E5-2699A V4**
- **UP TO 66 PERCENT BETTER PERFORMANCE ON A SINGLE-SOCKET SERVER COMPARED TO THE INTEL XEON PROCESSOR E5-2699 V4**
- **MOST IMPORTANT, A BETTER BALANCE OF RESOURCES TO MAKE YOUR REAL-WORLD WORKLOADS PERFORM BETTER: MORE CORES, MORE MEMORY, MORE MEMORY BANDWIDTH, AND MORE I/O CAPACITY**

The AMD EPYC™ 7601 system on chip (SoC) races past the best Intel Xeon E5 v4 processor CPU by up to 25% in integer and up to 59% in floating point performance—setting a total of four new world records for standalone CPUs on the SPEC CPU®2006 benchmarks.

It is common to see new technologies outperforming old ones on one or two measures. It is rare to see a new CPU outperform the market on both of the fundamental CPU performance benchmarks published by SPEC®. The new world records set by the AMD EPYC processor outperforms Intel's best CPU designed for 2-socket servers without add-on accelerators—setting a new performance expectation for 2-socket server performance. When comparing single-socket server results against the closest competing CPU having published results, the results are even more astonishing—up to 66% better floating-point and up to 32% better integer performance.

AMD EPYC OUTPERFORMS INTEL XEON BY UP TO 59%

BENCHMARK	2-SOCKET SERVER AMD EPYC 7601 64 CORES, 2.2 GHZ	2-SOCKET SERVER INTEL XEON E5-2699A V4 44 CORES, 2.4 GHZ	IMPROVEMENT
SPECFP [®] _RATE2006	<u>1840</u> ¹	<u>1160</u>	UP TO 59% ⁶
SPECINT [®] _RATE2006	<u>2360</u> ²	<u>1890</u>	UP TO 25% ⁷
	1-SOCKET SERVER AMD EPYC 7601 32 CORES, 2.2 GHZ	1-SOCKET SERVER INTEL XEON E5-2699 V4 22 CORES, 2.4 GHZ	IMPROVEMENT
SPECFP [®] _RATE2006	<u>943</u> ³	<u>568</u> *	UP TO 66%
SPECINT [®] _RATE2006	<u>1200</u> ⁴	<u>909</u> *	UP TO 32%

COMPARATIVE RESULTS WERE AVAILABLE FROM WWW.SPEC.ORG AS OF JUNE 20, 2017; EACH RESULT LINKS TO ITS CORRESPONDING DISCLOSURE
* NO INTEL XEON E5-2699A V4 RESULTS AVAILABLE FOR A 1-SOCKET SERVER SO E5-2699 RESULTS WERE USED IN THEIR PLACE.

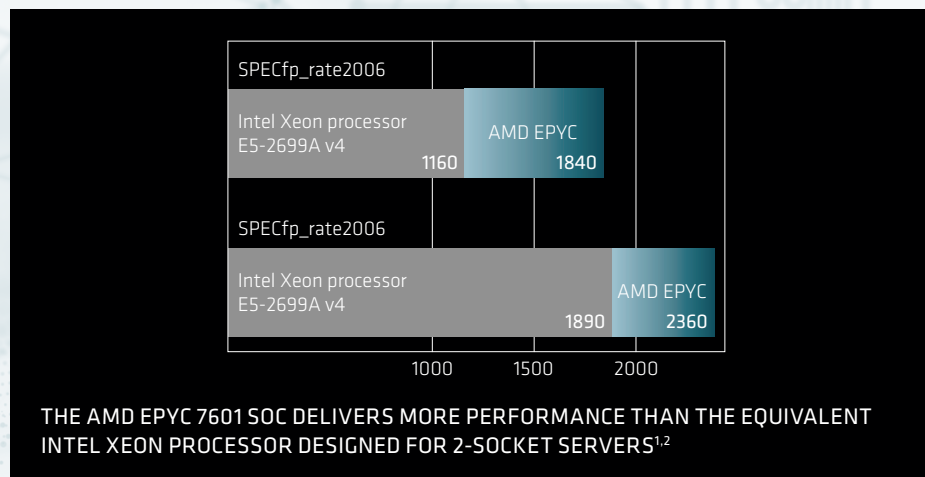
AMD EPYC SOC SETS WORLD RECORDS ON SPEC CPU BENCHMARKS

INNOVATION IS BECOMING EVER MORE IMPORTANT

The reason for these outstanding results is innovation. As the automatic leaps in processor performance predicted by Moore's Law become increasingly elusive, innovation becomes even more important today. With the AMD EPYC 7601 SoC able to deliver 64 cores of CPU performance in a 2-socket server configuration, the ability to package more cores in a comprehensive system on chip becomes essential to delivering superior performance. This is part of AMD's strategy of delivering a better balance of resources for better real-world application performance. The AMD EPYC SoC delivers more—more cores, more memory capacity and bandwidth, and massive I/O capacity⁵. Now you can use a single product line for a wide range of datacenter applications.

BORN IN A NEW ERA OF COMPUTING

AMD is leading innovation in the cloud era with an SoC that has been designed from the ground up to deliver real innovation to today's software ecosystem. It gives you greater flexibility, performance, and security, with the right ratio of CPU



cores to memory and I/O resources. This allows you to optimize your application performance with pinpoint accuracy. For enterprise applications, big data clusters, cloud computing, software-defined storage, machine learning, the Internet of Things (IoT), and the digital business transformation, AMD EPYC delivers:

- The highest number of cores⁵ on an x86-architecture server processor for handling highly parallel workloads
- The highest number of PCIe[®] lanes⁵ in the industry—now you can directly attach more NVMe devices, graphics accelerators or network interfaces to speed accelerate data processing and movement

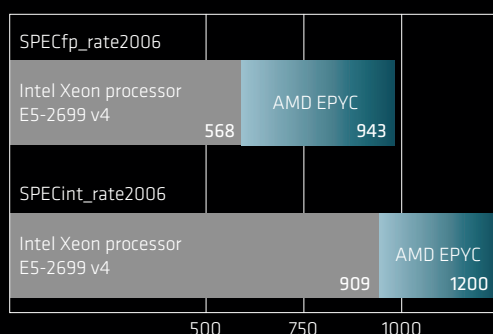
- Highest memory capacity⁵ per socket among x86-architecture servers to accommodate everything from more virtual machines to large in-memory databases
- Increased memory bandwidth⁵ to better balance the SoC's voracious appetite for data with the capacity to deliver it to the CPU cores
- A dedicated security processor in the SoC itself to protect your software and data as it is booted, as it runs, and as virtual machines move between servers

SPEC CPU BENCHMARKS

The SPEC CPU 2006 benchmark is a CPU-intensive benchmark suite that stresses a system's processor and memory. This suite includes SPECint_2006 to test integer performance and SPECfp_2006 to test floating-point performance.

RECOMPILE YOUR DATACENTER

CPU performance is a prerequisite to good application performance. As you accelerate your digital business transformation, you have a flexible new system on chip that lets you deliver performance where you need it most.



AMD EPYC SOC SETS WORLD RECORDS ON SPEC CPU BENCHMARKS

You help reduce business risk with cryptographically enforced data privacy and security. You can recompile your datacenter with silicon designed for software in a newly competitive x86 server market. With a better balance of resources you have performance, flexibility, and security to power your datacenter applications today and into the future.

LEARN MORE at amd.com/epyc.

FOOTNOTES

1. Scores based on AMD internal testing of 2 x EPYC 7601 CPU in Supermicro AS-1123US-TR4, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 512 GB (16 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD. NAP-12
2. AMD EPYC 7601-based system scored 2360 in AMD internal testing, and Intel E5-2699A v4-based system scored 1890 based on www.spec.com as of 29 May 2017. 2 x EPYC 7601 CPU in Supermicro AS-1123US-TR4, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 512 GB (16 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD; versus 2 x E5-2699A v4 CPU in Huawei RH2288H V3, Red Hat Enterprise Linux Server release 7.2, ICC v16.0.0.101 compiler suite, 512 GB (16 x 32GB 2Rx4 PC4-2400T-R) memory, 1 x 1000 GB SATA, 7200. NAP-13
3. Scores based on AMD internal testing of 1 x EPYC 7601 CPU in HPE Cloudline

CL3150, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 256 GB (8 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD. NAP-10

4. Scores based on AMD internal testing of 1 x EPYC 7601 CPU in HPE Cloudline CL3150, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 256 GB (8 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD. Comparison excludes Intel Xeon Phi accelerators. NAP-09

5. **MOST CORES:** the AMD EPYC™ processor includes up to 32 CPU cores versus the Xeon E5-2699A v4 processor with 22 CPU cores.

MORE MEMORY CAPACITY: the AMD EPYC processor offers up to 128 GB LRDIMMs in a 2-DIMM-per-channel configuration, so up to 256 GB/channel x 8 channels = 2.048 TB/processor, versus the Intel Xeon E5-2699A v4 processor with 128 GB LRDIMM in a 3-DIMM-per-channel configuration, so up to 384 GB/channel x 4 channels = 1.54 TB/processor.

MEMORY BANDWIDTH: the AMD EPYC processor supports up to 21.3 GB/s per channel with DDR4-2667 x 8 channels (total 170.7 GB/s), versus the Intel Xeon E5-2699A v4 processor with 19.2 GB/s with maximum DDR4-2400 x 4 channels (total 76.8 GB/s).

GREATER I/O DENSITY: AMD EPYC processor offers up to 128 PCI Express high-speed I/O lanes per socket, versus the Intel Xeon E5-2699A v4 processor

with 40 lanes per socket. NAP-02, NAP-03, NAP-04, NAP-05

6. AMD EPYC 7601-based system scored 1840 in AMD internal testing, and Intel E5-2699A v4-based system scored 1160 based on www.spec.com as of 29 May 2017. 2 x EPYC 7601 CPU in, Supermicro AS-1123US-TR4, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 512 GB (16 x 32 GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD; versus 2 x E5-2699A v4 CPU in, Lenovo System x3650 M5, SUSE Linux Enterprise Server 12, ICC v17.0.0.098 compiler suite, 256 GB (16 x 16 GB 2Rx4 PC4-2400T-R), 1 x 800 GB SATA SSD. NAP-14
 7. AMD EPYC 7601-based system scored 2360 in AMD internal testing, and Intel E5-2699A v4-based system scored 1890 based on www.spec.com as of 29 May 2017. 2 x EPYC 7601 CPU in Supermicro AS-1123US-TR4, Ubuntu 16.04, x86 Open64 v4.5.2.1 Compiler Suite, 512 GB (16 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD; versus 2 x E5-2699A v4 CPU in Huawei RH2288H V3, Red Hat Enterprise Linux Server release 7.2, ICC v16.0.0.101 compiler suite, 512 GB (16 x 32GB 2Rx4 PC4-2400T-R) memory, 1 x 1000 GB SATA, 7200. See www.spec.org. NAP-13
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