AMD EPYC SoC Delivers Exceptional Results on the STREAM Benchmark on 2P Servers

Up to 146% better memory bandwidth[3]

PERFORMANCE BRIEF
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HIGHLIGHTS

- **UP TO 146%BETTER MEMORY BANDWIDTH ON 2P SERVERS[3]** ON THE STREAM BENCHMARK COMPARED TO THE INTEL XEON PROCESSOR E5-2690 V4
- MOST IMPORTANT, **A BETTER BALANCE OF RESOURCES** TO HELP YOUR REAL-WORLD WORKLOADS PERFORM BETTER: MORE CORES, MORE MEMORY DENSITY, MORE MEMORY BANDWIDTH, AND MORE I/O DENSITY[1]

The AMD EPYC™ 7601 system on chip (SoC) races past the Intel Xeon processor E5-2690 v4 CPU in memory bandwidth by 146% on 2P servers[3].

Processor speeds are advancing faster than their associated memory systems. As this continues, your application performance may be limited, not by the processor speed, but by the fact that the processor can't get data from the memory fast enough. Your processors will become data-starved. The STREAM benchmark specifically tests memory bandwidth using datasets much larger than the available cache on any given system to determine how the balance between memory and CPU may affect the performance of very large, vector-style applications.

AMD EPYC OUTPERFORMS INTEL XEON BY UP TO 146%[3]

STREAM RESULTS	1-SOCKET SERVER AMD EPYC 7601 32 CORES, 2.2 GHZ, 512 GB MEMORY	2-SOCKET SERVER AMD EPYC 7601 64 CORES, 2.2 GHZ, 512 GB MEMORY	2-SOCKET SERVER INTEL XEON E5-2690 V4 44 CORES, 2.4 GHZ, 256 GB MEMORY	IMPROVEMENT 1-2	IMPROVEMENT 2-2
COPY (MB/S)	147,875	282,818	116,098	27%	144%
SCALE (MB/S)	147,951	286,313	115,347	28%	148%
ADD (MB/S)	149,710	291,532	118,123	27%	147%
TRIADD (MB/S)	149,375	290,228	118,015	27%	146%

COMPARATIVE RESULTS WERE BASED ON AMD INTERNAL TESTING[3,4]

INNOVATION IS BECOMING EVER MORE IMPORTANT

The reason for these outstanding results is innovation. With the AMD EPYC 7601 SoC able to deliver the highest memory capacity per socket among x86-architecture servers a single-socket server can now perform better than a 2-socket Intel Xeon server. 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 density.

AMD EPYC SOC DELIVERS UP TO 146% IMPROVEMENT ON STREAM BENCHMARKS ON 2P SERVERS

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 superior 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, as demonstrated by these results. For enterprise applications, scientific models, 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 cores on an x86-architecture processor for handling highly parallel workloads[1]
- The highest number of PCIe® lanes in the industry—now you can directly attach more NVMe devices, graphics accelerators or network interfaces to accelerate data processing and movement[1]
- Highest memory capacity per socket among x86-architecture servers to accommodate everything from more virtual machines to large in-memory databases[1]
- Increased memory bandwidth to better balance the SoC's voracious appetite for data with the capacity to deliver it to the CPU cores[1]
- 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 (some features depend on future software and/or hypervisor enhancements)

STREAM BENCHMARKS

The STREAM benchmark, created by John McCalpin and hosted at the University of Virginia, is a synthetic program that measures sustainable memory bandwidth, in megabytes per second (MB/s), and the corresponding computation rate for simple vector kernels[2].

RECOMPILE YOUR VECTOR APPLICATIONS

CPU performance isn't the only prerequisite to good application performance. Memory bandwidth plays an important role as well. As you accelerate your digital processing, you have a flexible new system on chip that lets you deliver performance where you need it most. You reduce business risk with cryptographically enforced data privacy and security. You can recompile your applications with silicon designed for your software in a newly competitive x86 server market. With a better balance of resources you have performance, flexibility, and security to power your applications today and into the future.

LEARN MORE at amd.com/epyc.

FOOTNOTES

1. 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

2. For more information on the STREAM benchmark, read: McCalpin, John D., 1995: "Memory Bandwidth and Machine Balance in Current High Performance Computers", IEEE Computer Society Technical Committee on Computer Architecture (TCCA) Newsletter, December 1995
   McCalpin, John D.: "STREAM: Sustainable Memory Bandwidth in High Performance Computers", a continually updated technical report (1991-2007), available at: http://www.cs.virginia.edu/stream/

3. 2-socket AMD EPYC 7601 delivers up to 146% more memory bandwidth than 2-socket Intel E5-2690 v4. In AMD internal testing on STREAM Triad, 2 x EPYC 7601 CPU in AMD "Ethanol" reference system, Ubuntu 16.04, Open64 v4.5.2.1 compiler suite, 512 GB (16 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD scored 290; versus 2 x E5-2690 v4 CPU in Intel Server System R1208WT2GSR, Ubuntu 16.04, GCC-02 v6.3 compiler, 256 GB (8 x 32GB 2Rx4 PC4-2666 running at 2400) memory, 1 x 500 GB SSD scored 118. NAP-22

4. In AMD internal testing on STREAM Triad, 1 x EPYC 7601 CPU in AMD "Ethanol" reference system, Ubuntu 16.04, Open64 v4.5.2.1 compiler suite, 256 GB (8 x 32GB 2Rx4 PC4-2666) memory, 1 x 500 GB SSD scored 147; versus 2 x E5-2690 v4 CPU in Intel Server System R1208WT2GSR, Ubuntu 16.04, GCC-02 v6.3 compiler, 256 GB (8 x 32GB 2Rx4 PC4-2666 running at 2400) memory, 1 x 500 GB SSD scored 118. NAP-21

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