



THIS IS EPYC™

SHATTERING INDUSTRY EXPECTATIONS WITH AMD EPYC™ PROCESSORS



A Point of View by Forrest Norrod, SVP & GM, Datacenter and Embedded Solutions Group, AMD

The demand for compute cycles is growing at an incredible rate. Scientists and product designers are using computers to attack some of the world's more challenging problems, from weather modeling to climate change, to product modeling/simulation and medical research. Cloud computing and internet-delivered services are transforming IT, enabling new applications and allowing the migration of many others to massive centralized data centers. At the same time, enterprise data centers have become increasingly more virtualized to bring cloud-like agility for on-premise applications.

All these trends drive the need for more compute performance per server. We designed EPYC for this new era. We wanted to make sure we had a processor that set us apart from the status quo, offering far more cores, memory bandwidth, and I/O capability than anything else in the market. With EPYC, AMD is shattering customer and industry expectations around what a processor can do in the areas of high performance computing, enterprise virtualized data centers, and cloud computing.

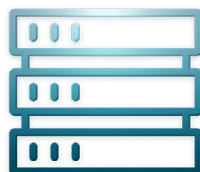
HIGH PERFORMANCE COMPUTING (HPC)

Solving the world's toughest scientific challenges with leadership floating point-performance¹ that is truly usable.



ENTERPRISE IT

Offering differentiated total cost of ownership (TCO) that disrupts the equation around virtualized infrastructure and can free up dollars for use on new innovations and new capabilities.



CLOUD SERVICE PROVIDERS (CSP)

Delivering virtual instances for social services to media streaming and beyond.



Whether you're looking for improvements to your HPC, enterprise IT or cloud environments, read on to find out what AMD EPYC processors can do for you.

High Performance Computing

The top tier of Formula car racing is known for the fastest, most technologically impressive cars the world has ever seen and, each year, these cars are built from scratch. AMD's EPYC server processor is helping racing teams with the heavy workload of carrying out computational fluid dynamics (CFD) simulations to run virtual wind tunnel tests, predict and reduce drag, and improve aerodynamics. The floating-point performance and memory bandwidth of AMD EPYC server processors are a perfect match for these types of high performance computing applications, which need to be run many times in a short period to optimize cars on schedule. EPYC has outstanding floating-point capabilities with world record performance¹ in multiple floating-point benchmarks and real HPC applications.

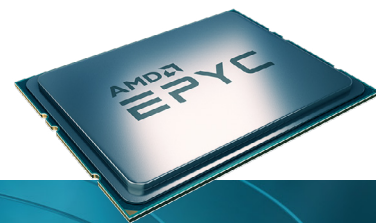
What this means is faster results with better outcomes with up to:

44% *FASTER* **WEATHER MODELING²**

48% *FASTER* **ANSYS FLUENT/ PRODUCT DESIGN³**

41% *FASTER* **NAND MOLECULAR DYNAMICS/GENE DISCOVERY⁴**

Supercomputing leader, Cray, embraced AMD in a major way when its AMD EPYC-based CS500 was adopted by a formula car racing team. Even more exciting is our EPYC-based win with the Cray Shasta platform – an exascale-class supercomputer – with one of the first adopters being the National Energy Research Scientific Computing Center (NERSC). Beyond these systems, The University of Notre Dame, Lawrence Livermore National Labs, and the High Performance Computing Center in Germany recently announced AMD-based HPC solutions.



EPYC has outstanding floating-point capabilities with world record performance¹ in multiple floating-point benchmarks and real HPC applications.^{5,6}

Enterprise IT: Single Socket Advantage

Historically ~80% of servers sold are 2P systems, even though the performance of a dual socket system is seldom needed. Until now it was very difficult to find a single socket system that had the reliability, memory capacity, and I/O capabilities that met customers' requirements.

With EPYC, we developed a server processor with a 1P configuration that can outperform competitive 2P systems⁵ while supporting industry-leading reliability, security, memory capacity, and I/O capability.

A single AMD EPYC processor allows enterprises to buy the right size and the right system for their workload, without compromising on performance, reliability, or features. Thus, ducking the constraints that force users of Intel-based systems into a 2P server when a 1P system would offer a better choice.

What does this mean?

A disruptive TCO advantage for customers running virtualized environments – where you can achieve up to:

45% *LOWER* **TCO⁶ COMPARING 2P EPYC POWERED SERVERS TO THE COMPETITION**

WE'VE ESTIMATED HARDWARE COSTS GO DOWN BY UP TO 29%

WE'VE ESTIMATED SOFTWARE LICENSING COSTS GO DOWN BY UP TO 63%

AND VM DENSITY INCREASES DRAMATICALLY

This allows you to reclaim budget, space, and capacity to do new things. That is a tremendous saving for enterprise customers.

Winning in the Cloud

Prefer to take advantage of AMD EPYC server processors in a public or hybrid cloud, or as a hosted service? No problem.

Almost every major public cloud provider has announced instances available on AMD EPYC, plus a range of enterprise and managed hosting partners offer EPYC-based systems. All have enabled unique and differentiated offerings with each one taking a slightly different path.

Many customers in managed services and hosting have embraced the single socket capabilities of EPYC and offer disruptive power/performance and cost/performance in a managed hosting environment.



Offers their storage optimized

LV2-SERIES
ON EPYC AND ITS
LSV2-SERIES

FOR MEMORY INTENSIVE
WORKLOADS LIKE BIG
DATA APPLICATIONS



Offers EPYC on their most popular cloud instances.

BUSINESSES CAN SAVE

10%

BY MIGRATING THEIR
INSTANCES TO EPYC ON
AMAZON WEB SERVICES
(AWS)



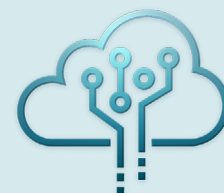
Offers virtualized and bare metal instances providing:

UP TO

66%
LOWER

COST PER CORE THAN
GENERAL PURPOSE
INSTANCES OFFERED
BY OTHER CLOUD
SERVICE PROVIDERS

With a single AMD EPYC server processor, a **Hivelocity client** experienced read/write speeds six times faster than that of two Xeon Processors.



Ecosystem in Place

Of course, a server doesn't perform in isolation: it's part of complex ecosystem of software and hardware, and needs to integrate seamlessly into your existing infrastructure if you're to benefit from its performance advantages.

AMD EPYC server processors are certified by industry-leading hypervisors and server operating system vendors, while more than 50 EPYC platforms are now shipping from the leading server OEMs.

MORE THAN

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Innovating for Performance

The next-generation 7nm AMD EPYC server processor, with up to 64 cores and 128 threads per socket, brings even more possibilities to combine affordability with stunning performance

We've explored the opportunities to achieve new standards of server performance when you choose AMD EPYC server processors. Today, companies are doubling infrastructure capability, saving huge amounts in infrastructure costs by choosing to migrate to a cloud provider such as Oracle running EPYC-based instances, and solving the world's toughest challenges like running 44% faster on WRF, freeing you up to push the envelope even further.

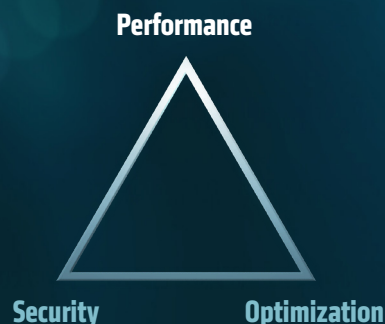
And, this is just the beginning. The next-generation 7nm AMD EPYC server processor, with up to 64 cores and 128 threads per socket, brings even more possibilities to combine affordability with stunning performance. We are committed to server processor innovation for the long-term, our product roadmap is on track, and we are forging close partnerships across the ecosystem to change the data center with EPYC.

Learn more about AMD EPYC server processors from a product expert

CONTACT US

The server capability triangle

Consider these three factors when you are reviewing your next investment in servers or cloud services. Make sure you're satisfied with your choice of processor and that it delivers what you need in all three areas, and especially that you're not gaining one capability at the expense of another.



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Advanced Micro Devices, Inc., 2485 Augustine Drive, Santa Clara, CA 95054 USA

1 Source: The EPYC 7601 processor has the highest SPECrate®2017_fp_peak scores for both 1P and 2P. 1P at <https://www.spec.org/cpu2017/results/res2018q2/cpu2017-20180426-05035.html>. 2P at <https://www.spec.org/cpu2017/results/res2018q2/cpu2017-20180319-04087.html>. SPECrate®2017_fp_peak as of Oct 30, 2018. [https://www.spec.org/cpu2017/results/](https://www.spec.org/cpu2017/results/.). SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

2 Source: Internal AMD testing using the WRF v3.9.1.1 benchmark, 12km model size, compiled with gcc 7.3.0, using OpenMPI v.3.1.1 and NetCDF v.1.1.3 comparing a Supermicro AS -1123US-01-AM036 configured with 2x EPYC 7601 CPUs, 16x16GB DDR4 2666MHz DIMMs and Ubuntu 18.04 vs a Supermicro SYS-1029U-TRTP configured with 2x Intel Xeon Platinum 8180 CPUs, 24x16GB DDR4 2666MHz DIMMs and Ubuntu 18.04.

3 Based on AMD internal testing of ANSYS FLUENT v19.1 as of January 20, 2019 and Intel results on ANSYS FLUENT v19.0 published by ANSYS as of January 20, 2019. 206.8 Core Solver Rating on combustor 71m benchmark using 16 x AMD EPYC Processor 7451 (24-core 2.3GHz) in 8 servers (2 processors per server), 256GB DDR4-2666 memory per server, Mellanox ConnectX-5 EDR 100Gb InfiniBand x16 PCIe® per server, 1 x 256GB NVMe (OS storage) per server, 1 x 1TB NVMe (Data storage) per server, Red Hat® Enterprise Linux 7.5, MLNX_OFED_LINUS-4.3-3.0.3.1 OFED Driver, Mellanox EDR 100Gb/s Managed Switch (MSB7800-ES2F), ANSYS FLUENT v19.1, SMT=OFF, Boost=ON, Determinism Slider = Power, Transparent Huge Pages=ON, Swappiness=0, Governor = Performance.

139.2650 Core Solver Rating on combustor 71m benchmark using 16 x Intel Xeon Gold Processor model 6148 (20-core 2.4 GHz) in 8 Cray XC50 servers (2 processors per server), Cray Linux Enterprise 6.0 update 07 based on SUSE 12 SP3, Cray Aries network, FLUENT AVX2 binary. <https://www.ansys.com/solutions/solutions-by-role/it-professionals/platform-support/benchmarks-overview/ansys-fluent-benchmarks/ansys-fluent-benchmarks-release-19/flow-through-combustor-71m>. Testing with other EPYC or Intel parts may result in different performance results. NAP-138

4 Source: Third party testing. Results from AnandTech testing - <https://www.anandtech.com/show/11544/intel-skylake-ep-vs-amd-epyc-7000-cpu-battle-of-the-decade/21>. Results not independently verified by AMD.

5 AMD EPYC 7281 1k unit price Feb 2019 for \$650 USD. Two Intel Xeon Gold 5118 pricing from <https://ark.intel.com/>. Feb 2019 for \$834 USD. Performance based on SPEC CPU® 2017 scores published on www.spec.org as of February 5, 2019. AMD EPYC 7551P 1P system scored 135, results found at <http://spec.org/cpu2017/results/res2018q3/cpu2017-20180723-07954.pdf> Xeon 5118 2P system scored 123, results found at <http://spec.org/cpu2017/results/res2019q1/cpu2017-20190108-10679.pdf>. NAP-137

6 Compares 3-year Total Cost of Ownership (TCO) for 320 virtual machines provisioned with 1 core and 8GB of DRAM per virtual machine, having similar performance. Example only, actual results may vary.

- (14) Dell PowerEdge R740 servers with (2) Intel® Xeon® Gold 5118 processors, (12) 16GB RDIMM, 2666MT/s, Dual Rank DIMMs, Hard Drives including (1) 120GB SSD SATA, 2.5in Boot drive & (6) 480GB SSD SAS Mix Use 12Gbps 512n 2.5in Hot-plug Drives, No Operating System, 3 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite Deployment Services, No Installation. Configuration priced on 8/30/2018 at www.dell.com for \$14,271 per server; \$199,794 total Hardware Acquisition Cost. Facilities and administration costs include \$16,004 for power and cooling, \$540 for space, and \$42,880 for IT administration costs for a total of \$59,424 over 3 years - calculated based on AMD EPYC™ TCO calculator at <https://uafast.valuestoryapp.com/AMD/sales>. SW Licensing costs include (14) vSphere with Ops Manager Ent Plus, 2 CPU License, 5Yrs ProSupport + Subscription for \$12,163 each for a total SW licensing costs of \$170,282. Pricing obtained at www.dell.com on 8/30/18. Total 3 yr. Cost of Ownership of \$429,500. Total cost per VM per year: \$447.

- (10) Dell PowerEdge R7425 servers with (2) AMD EPYC™ 7351 processors, (16) 16GB RDIMM, 2666MT/s, Dual Rank DIMMs, Hard Drives including (1) 120GB SSD SATA, 2.5in Boot Drive & (6) 480GB SSD SAS Mix Use 12Gbps 512n 2.5in Hot-plug Drives, No Operating System 3 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite Deployment Services, No Installation. Configuration priced on 8/30/2018 at www.dell.com for \$16,351 per server; \$163,510 total Hardware Acquisition Cost. Facilities and administration costs include \$5,438 for power and cooling, \$540 for space, and \$34,304 for IT administration costs for a total of \$40,282 over 3 years - calculated based on AMD EPYC™ TCO calculator at <https://uafast.valuestoryapp.com/AMD/sales>. SW Licensing costs include (10) vSphere with Ops Manager Ent Plus, 2 CPU License, 5Yrs ProSupport + Subscription for \$12,163 each for a total SW licensing costs of \$121,638. Pricing obtained at www.dell.com on 8/30/18. Total 3 yr. Cost of Ownership of \$325,430. Total cost per VM per year: \$339.

- (10) Dell PowerEdge R6415 servers with (1) AMD EPYC™ 7551P processor, (8) 32GB RDIMM, 2666MT/s, Dual Rank DIMMs, Hard Drives including (1) 120GB SSD SATA, 2.5in Boot Drive & (6) 400GB SSD SAS Mix Use 12Gbps 512n 2.5in Hot-plug Drives, No Operating System 3 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite Deployment Services, No Installation. Configuration priced on 8/30/18 at www.dell.com for \$13,585 per server; \$135,850 total Hardware Acquisition Cost. Facilities and administration costs include \$5,438 for power and cooling, \$540 for space, and \$34,304 for IT administration costs for a total of \$40,282 over 3 years - calculated based on AMD EPYC™ TCO calculator at <https://uafast.valuestoryapp.com/AMD/sales>. SW Licensing costs include (10) vSphere with Ops Manager Ent Plus, 1 CPU License, 5Yrs ProSupport + Subscription for \$6,081 each for a total SW licensing costs of \$60,810. Pricing obtained at www.dell.com on 8/30/18. Total 3yr Cost of Ownership of \$236,942. Total cost per VM per year: \$247. NAP-122 (NAPT-2)