

AVOID THE “INTEL TAX” WITH AMD EPYC™ PROCESSORS



Intel’s bottlenecks force you up the processor stack to get the resources you need.

INTEL MISSES THE MARK

In a market without meaningful competition, Intel has been able to increase prices a 19% compound annual growth rate (CAGR) between 2012 and 2017¹. In this comfortable situation, Intel missed delivering what the market needs: more and balanced server resources, increased application performance, and reduced total cost of ownership (TCO).

THE VALUE OF BALANCE

The key to building a workload-optimized server is balancing resources to optimize performance and TCO. Virtualization and cloud workloads need larger and faster memory with faster access and more cores. Big data needs fewer cores but more memory and massive amounts of disk storage and I/O capacity. HPC needs high floating-point throughput and threads.

INTEL’S STRATEGY

When you try to optimize a server design using Intel Xeon Scalable processors, you find yourself in a maze of more than 42 different processor SKUs, 4 different metal codes, and 5 different series. You can quickly find yourself having to buy what you don’t want in order to get what you need. Almost like buying a car: you just want to stream music from your phone, but to do that you need to buy the \$3,000 navigation system. Sound familiar?

We call it the “Intel Tax.” It is the extra price for Intel processors that you have to pay to get the features and performance you need. Intel’s product line is filled with self-imposed, designed-in performance bottlenecks

that affect real-world results. You are forced to buy a more expensive processor to get the performance that you need. Here’s how:

- **MEMORY SIZE:** if you need more memory for virtualization or cloud, you could pay \$3,000 *per processor* just to have more RAM (DIMMs not included)².
- **MEMORY PERFORMANCE:** the need for faster memory makes you buy up the stack to the top tiers of Gold and Platinum processors³.
- **CPU CORES:** for more than 28 cores, you have to add a second processor⁴. If you want fewer cores to reduce licensing costs you have to sacrifice features such as memory capacity⁸ or bandwidth⁹.
- **I/O CONNECTIVITY:** With Intel, to increase I/O capacity, you have to add a second processor and even then you may not have capacity to directly attach all the I/O devices you need⁶.

AMD’S APPROACH

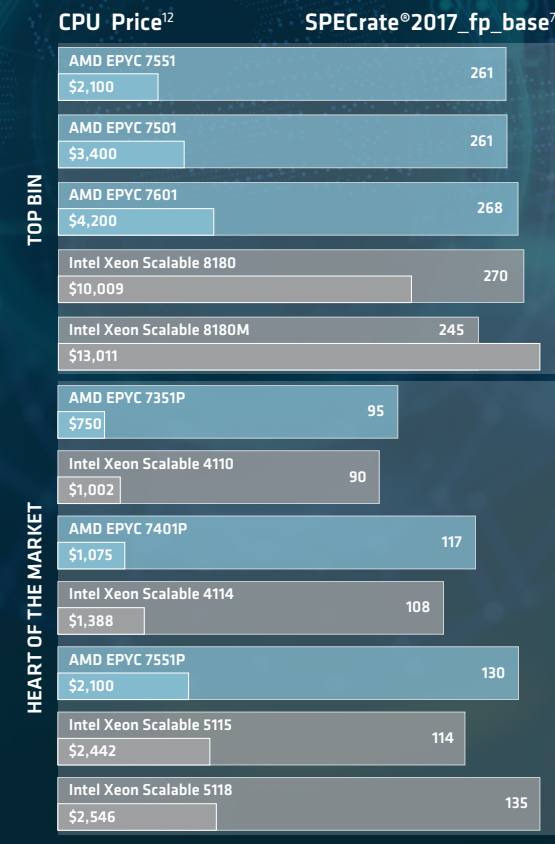
While Intel has seemingly been ignoring the Heart of the Market, we have designed a new x86-architecture processor that delivers stunning performance at every competitive price point—and that doesn’t make you sacrifice features just so you can optimize TCO.

Every AMD EPYC™ system on chip (SoC) has the same feature set and delivers more of what you need, where you need it, free of the “Intel Tax.” The AMD EPYC product line offers balance without compromises:

- **MORE CORES⁴:** drive application performance and, in many cases, with only a single socket.

VALUE OF PERFORMANCE

YOU GET WHAT YOU PAY FOR: COMPARED TO AMD, INTEL PERFORMANCE DOES NOT JUSTIFY A MUCH HIGHER COST. THE GRAPHS BELOW ARE SORTED BY PRICE WITH PERFORMANCE OVERLAID.



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- **MORE MEMORY:** higher capacity than any Intel Xeon Scalable processor⁸, support for fast DIMMs at every price point, and one third more memory bandwidth⁹.
- **MORE I/O:** across the board with 128 lanes of PCIe[®] Gen3 connectivity to speed I/O, propel graphics-intensive workloads⁶, and support hard drives.
- **SOFTWARE LICENSE SAVINGS:** when you choose a single socket¹⁴ or lower total core count to save on licensing costs, you don't have to sacrifice features like memory capacity⁸ or bandwidth⁹.
- **LEADING-EDGE SECURITY FEATURES:** processor-based memory encryption as well as isolation and encryption of virtual machines helps protect from external threats.

BREAKTHROUGH PERFORMANCE

For customers who need to drive higher performance, the AMD EPYC 7601 has 9% better performance⁷ at one third the cost¹² vs. the Intel Xeon Scalable 8180M. What you pay for performance from Intel varies wildly because of their complicated product strategy. For every price point, at the Top or Heart of the Market, AMD EPYC processors deliver better performance value, and drive improved TCO (Figure 1).

Consider how you can meet your computing needs with better performance value:

- **HEART OF THE MARKET:** instead of two Intel Xeon Scalable 5115 processors, for \$684 less¹² you can get

twelve more cores¹³, 13% better performance⁷, and half the VMware license cost¹⁴ with a single-socket AMD EPYC 7551P.

- **PRICE AND PERFORMANCE:** if you need Intel Xeon Scalable 6146 performance⁷ select the AMD EPYC 7351. Cut your cost by 66%¹² and still get better performance⁷.
- **TOP OF THE MARKET:** If you need a top-bin server, choose the AMD EPYC 7601 and get more. It delivers better performance⁷ with more memory capacity⁸, greater bandwidth⁹, more cores⁴, and more I/O⁶ than the Intel Xeon Scalable 8180—all at a price that slashes processor cost by almost 60%¹²!

THIS IS EPYC™

The AMD EPYC SoC is a disruptive force bringing choice back to the processor marketplace. No longer are you captive to Intel's practice of forcing you to buy up the stack to get the features you need, while driving up your cost. Now you can optimize workloads without having to pay the “Intel Tax.”

The value of AMD EPYC is that you get the freedom to match system resources to workload requirements and optimize your TCO at the same time. You are free to choose the CPU performance you need and get the full feature set of memory, I/O bandwidth, memory speed, and even security features that you want to get the job done—all with no price penalty. We understand the value of performance and are bringing EPYC changes to data center technologies.

MORE INFORMATION

For more information visit [AMD EPYC](https://www.amd.com/en/epyc)

FOOTNOTES

1. A cumulative annual growth rate (CAGR) of 25% in Intel pricing for top-bin processors for 2-socket servers is based on ark.intel.com prices and launch dates from 2012 to 2017 for the following processors retrieved 7/10/2018: [Intel Xeon E5-2690](https://ark.intel.com) (\$2,061), [E5-2697 v2](https://ark.intel.com) (\$2,618), [E5-2697 v3](https://ark.intel.com) (\$2,706), [E5-2699 v4](https://ark.intel.com) (\$4,115), [8180](https://ark.intel.com) (\$10,009).
2. Intel Xeon Scalable processors support 768 GB of memory in 2-socket configurations. To reach 1.5 TB of memory capacity, you must specify the 'M' version of a processor, which is a minimum \$3,000 uplift according ark.intel.com as of 7/10/2018. For example, the Intel Xeon Gold 6140M is priced \$3,003 higher than the 6140.
3. According to ark.intel.com as of 7/10/2018, Intel Xeon Scalable processors in the Bronze and Silver metals and the Gold range up through 5120 do not support high-speed DDR-4-2666 memory.
4. AMD EPYC 7601 processor includes up to 32 CPU cores versus the Xeon Platinum 8180 processor with 28 CPU cores. NAP-43
5. For example, according to ark.intel.com as of 7/10/2018, to optimize licensing costs with an 8-core processor requires an Intel Xeon Silver 4110 processor or lower, which only supports DDR4-2400 memory. No Silver or Bronze processor supports 1.5 TB of memory.
6. AMD EPYC™ processor supports up to 128 PCIe[®] Gen 3 I/O lanes (in both 1 and 2-socket configuration), versus the Intel[®] Xeon[®] SP Series processor supporting a maximum of 48 lanes PCIe[®] Gen 3 per CPU, plus 20 lanes in the chipset (max of 68 lanes on 1 socket and 116 lanes on 2 socket). NAP-56
7. Results obtained from spec.org on 8/27/2018 for the top-performing SPECrate2017_fp_base results for each of the following CPUs: [AMD EPYC 7551](https://ark.intel.com), [AMD EPYC 7501](https://ark.intel.com), [AMD EPYC 7601](https://ark.intel.com), [AMD EPYC 7351](https://ark.intel.com), [AMD EPYC 7351P](https://ark.intel.com), [AMD EPYC 7401P](https://ark.intel.com), [AMD EPYC 7551P](https://ark.intel.com), [Intel Xeon 8180](https://ark.intel.com), [Intel Xeon 8180M](https://ark.intel.com), [Intel Xeon 4110](https://ark.intel.com), [Intel Xeon 4114](https://ark.intel.com), [Intel Xeon 5115](https://ark.intel.com), [Intel Xeon 5118](https://ark.intel.com).
8. A single AMD EPYC 7601 processor offers up to 2TB/processor (x 2 = 4TB), versus a single Xeon Platinum 8180 processor at 768Gb/processor (x 2 = 1.54TB). NAP-44
9. AMD EPYC 7601 processor supports up to 8 channels of DDR4-2667, versus the Xeon Platinum 8180 processor at 6 channels of DDR4-2667. NAP-42
10. The top [SPECrate2017_fp_base](https://spec.org) score obtained on 7/10/2018 for a server with two Intel Xeon 6146 processors was 173, while the score for a server with two AMD EPYC 7501 was 261, an improvement of 50.86 percent.
11. An Intel Xeon 6146 has 12 cores and an AMD EPYC 7501 processor has 32 cores, which is 20 more cores.
12. Intel pricing obtained from ark.intel.com as of 8/27/2018, AMD pricing per AMD 1k unit pricing June 2017. AMD EPYC 7351 price is 66.5% less than Intel Xeon 6146 price: (\$6572-\$2200) * 100 / \$6572. AMD EPYC 7601 price is 58% less than the Intel Xeon 8180 price: (\$10,009-\$4,200) * 100 / \$10,009.
13. According to ark.intel.com as of 8/30/2018, the Intel Xeon Gold 5115 has 10 cores per socket and 2 sockets would provide 20 cores; The AMD EPYC 7551P single socket processor has 32 cores; 12 more cores than 2 Intel Xeon Gold 5115 processors.
14. [VMware vSphere](https://www.vmware.com) pricing is per processor, so 1-socket servers have half the licensing cost of 2-socket servers.