

The Value of Using Four-Channel Optimized AMD EPYC™ CPUs in PowerEdge Servers

Tech Note by

Matt Ogle
Mohan Rokkam

Summary

AMD recently launched their 2nd generation of AMD EPYC™ CPUs, and with this launch came the announcement of an additional set of four-channel optimized SKUs.

Considering AMD CPUs have eight memory channels, there has been uncertainty as to why these SKUs were created and how they are beneficial.

This DfD will educate readers on the architecture modifications made for four-channel optimized AMD EPYC™ CPUs, as well as the suggested use cases and value they bring to PowerEdge servers.

Introduction

Most 2nd generation AMD EPYC™ CPUs contain four memory controllers each with two memory channels; a total of eight memory slots that need to be populated for an optimized configuration. However, several CPU SKUs were modified to optimize performance with only four memory slots populated. These four-channel optimized SKUs require only two memory controllers to be fully populated for an optimized solution, and ultimately provide a lower cost alternative to traditional eight-channel solutions. The remaining channels can always be filled in if more memory is required.

Four-Channel Architecture and Positioning

These four-channel optimized CPUs, such as the [AMD EPYC™ 7252](#) and the [AMD EPYC™ 7282](#), contain a unique architecture that was designed to best support two fully populated memory controllers. [Figure 1](#) below illustrates at a high level the architecture differentiation between four-channel optimized and eight-channel optimized CPUs.

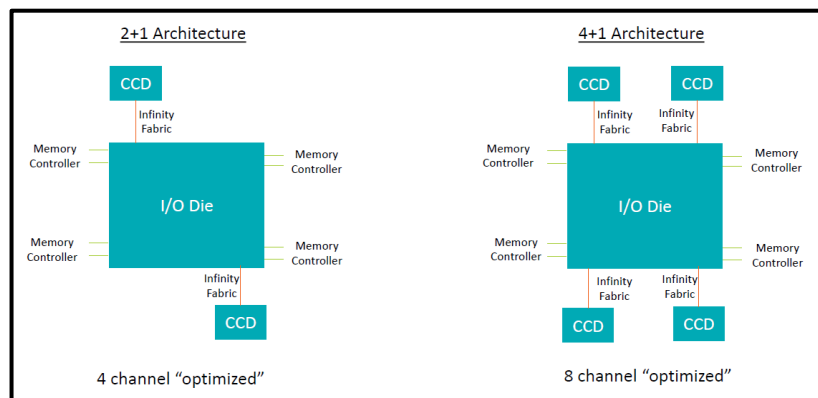


Figure 1 – Block diagram illustrating the distinctions between four-channel optimized and eight-channel optimized architectures

The Core Complex Die, or CCD, count is reduced from four to two per CPU. Both memory controllers closest to the CCD quadrant should be populated with two memory modules so the I/O die can route and distribute data packages across the smallest travel distance possible. Populating this way enables performance similar to eight-channel data transfer speeds for specific workloads. Additionally, reducing the number of CCDs lowers the total solution cost, effectively generating an increased performance per price value proposition.

Positioning

Various workloads were tested to compare performance with the eight-channel optimized SKUs. Most workloads do indeed gain an increased performance per price. Customers that prioritize pricing over everything else should find the cost-savings of four-channel optimized CPUs an attractive feature to consider.

However, there are some limitations and caveats that make this technology inadequate for specific workloads. The most obvious caveat is that by populating only four memory modules per CPU, the memory bandwidth and latency are essentially halved, and this should be considered for customers running memory-dense workloads. Additionally, the CPU base/max clock frequency have been slightly reduced and the total L3 cache has been halved. Please reference [Figure 2](#) below for Dell EMC recommended positioning:

| WORKLOAD | AVERAGE PERFORMANCE PER PRICE VARIANCE <i>(7282.4ch vs. 7302.4ch)</i> | BENCHMARK(S) | RECOMMENDED POSITIONING |
|--|--|----------------------------------|---|
| Collaboration (Conference, Web Conference, IM, Email, Enterprise Social Networks, File Sharing) | +10% | SPECint 2017 | RECOMMENDED - Exceptional increase in performance per price, with minimal risk of negative impact |
| Web Servng (HTTP, PHP, Javascript) | +7% | Apache, PHP Bench | RECOMMENDED - Exceptional increase in performance per price, with minimal risk of negative impact |
| Web Based Applications (Java) | +7% | DeCapo, Renaissance | RECOMMENDED - Exceptional increase in performance per price, with minimal risk of negative impact |
| Content Creation (Video Encoding, Image Processing) | +6% | Graphics-Magick, gimp, gegl | RECOMMENDED - Exceptional increase in performance per price, with minimal risk of negative impact |
| Video Rendering | +5% | Blender, C-Ray | NOT RECOMMENDED - Despite having marginal increase in performance per price, limited core count can become disadvantageous |
| Databases (Excluding Enterprise class) | +4% | Redis, RocksDB, Cassandra | NOT RECOMMENDED - Despite having averaged increase in performance per price, too much variance occurred for tested DBs, as some DB had large decrease in performance |
| Compress | +4% | 7-Zip, XZ | NOT RECOMMENDED - Despite having marginal increase in performance per price, lower core frequencies can become disadvantageous |
| Compile | +1% | Build GCC, Build LLVM, Build PHP | NOT RECOMMENDED - Despite having marginal increase in performance per price, lower core frequencies can become disadvantageous |
| Memory (Bandwidth and Latency) | -1% | STREAM, RAMSPEED | NOT RECOMMENDED - There is limited-to-no increase in performance per price |
| HPC | -2% | NPB, NAMD, GROMACS, DGEMM | NOT RECOMMENDED - There is limited-to-no increase in performance per price |

Figure 2 – Dell EMC recommended positioning for customers looking to purchase AMD 4-channel SKU CPUs

Conclusion

AMD four-channel optimized CPUs can provide great value for various workloads and should be considered by customers that prioritize a lower TCO as an alternative to AMD eight-channel optimized CPUs.



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