SIMULIA® ABAQUS® AND AMD 3D V-CACHE™ TECHNOLOGY
EXPLICIT FINITE ELEMENT ANALYSIS

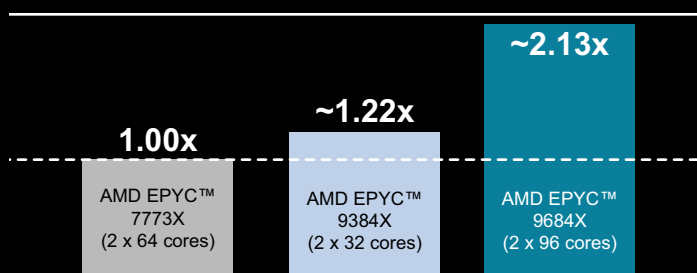Powered by 4th Gen AMD EPYC™ Processors with AMD 3D V-Cache™ technology

June 2023

AT A GLANCE

2P systems powered by 32-core and 96-core 4th Gen AMD EPYC™ processors with AMD 3D V-Cache™ technology demonstrate superb generational performance uplifts on SIMULIA® Abaqus/Explicit™ vs 64-core 3rd Generation AMD EPYC™ processors.

PERFORMANCE HIGHLIGHTS

A single 2P 32-core 4th Gen AMD EPYC 9384X system demonstrates a ~1.22x uplift vs. a single "high core count" 3rd Gen AMD EPYC 7773X system on an average of Abaqus/Explicit workloads. A single 2P 96-core 4th Gen AMD EPYC 9684X system demonstrates a ~2.13x uplift vs the same single "high core count" 3rd Gen AMD EPYC 7773X system. All systems tested employ AMD 3D V-Cache technology (described below).

2P AMD EPYC™ 9684X AND 2P AMD EPYC™ 9384X
VERSUS 2P AMD EPYC™ 7773X (NORMALIZED TO 7773X)

	~1.22x	~2.13x
1.00x		
AMD EPYC™ 7773X (2 x 64 cores)	AMD EPYC™ 9384X (2 x 32 cores)	AMD EPYC™ 9684X (2 x 96 cores)

KEY TAKEAWAYS

A 2P server powered by 4th Gen AMD EPYC 9684X (96-core) processors with AMD 3D V-Cache technology delivered a high core count composite average Abaqus/Explicit generational performance uplift of ~2.13x compared to a 2P server powered by prior-generation high core count 64-core 3rd Gen AMD EPYC 7773X processors with AMD 3D V-Cache technology. Further, a 2P server powered by 32-core 4th Gen AMD EPYC 9384X processors outperformed a 2P server powered by the same previous high core count 64-core 3rd Gen AMD EPYC 7773X processor with an uplift of ~1.22x. 4th Gen AMD EPYC 9004 processors with AMD 3D V-Cache technology are available in 1P and 2P configurations and feature:

- Up to 1,152MB L3 cache vs. 384MB in standard 4th Gen AMD EPYC processors.
- Up to 4 links of Gen 3 Infinity Fabric™ at up to 32 Gbps.
- 12 memory channels that support up to 6TB of DDR5-4800 memory.

- Support for PCIe® Gen 5 at up to 32 Gbps.
- AVX-512 instruction support for enhanced HPC and ML performance.
- AMD Infinity Guard technology to defend your data.[2]

IN THIS BRIEF

AMD 3D V-CACHE™ TECHNOLOGY

Some AMD EPYC 9004 Series Processors include AMD 3D V-Cache™ die stacking technology that enables more efficient chiplet integration. AMD 3D Chiplet architecture stacks L3 cache tiles vertically to provide up to 96MB of L3 cache per die (and up to 1152 MB L3 Cache per socket) while still providing socket compatibility with all AMD EPYC™ 9004 Series Processor models.

AMD EPYC 9004 Series Processors with AMD 3D V-Cache technology employ industry-leading logic stacking based on copper-to-copper hybrid bonding "bumpless" chip-on-wafer process to enable over 200X the interconnect densities of current 2D technologies (and over 15X the interconnect densities of other 3D technologies using solder bumps),[3,4] which can translate to lower latency, higher bandwidth, and greater power and thermal efficiencies.

SYSTEM CONFIGURATION

AMD SYSTEM CONFIGURATION			
CPUs	2x AMD EPYC 7773X	2 x AMD EPYC 9384X	2 x AMD EPYC 9684X
Frequency: Base | Boost[5]	2.20 GHz | 3.50 GHz (up to)	3.10 GHz | 3.90 GHz (up to)	2.55 GHz | 3.70 GHz (up to)
Cores	64 cores/socket (128 threads)	32 cores/socket (64 threads)	96 cores/socket (192 threads)
L3 Cache	768 MB per CPU	768 MB per CPU	1152 MB per CPU
Memory	1.5 TB (24x) Dual-Rank DDR5 4800 64 GB DIMMs 1 DPC		
NIC	25 Gb Ethernet CCX512-A ConnectX-5 (fw 16.35.2000)		
InfiniBand	200 Gb HDR ConnectX-6 VPI (fw 20.35.2000)		
Storage: OS | Data	Samsung MZQL21T9HCJR-00A07 1.92 TB		
BIOS Version	1009B	1007D	
BIOS Settings	SMT=OFF; NPS=4; Determinism=Power		
OS	RHEL 8.7 (kernel 4.18.0-425.3.1.el8.x86_64)		
OS Settings	amd_iommu=ON; iommu=pt; mitigations=off; clear caches; NUMA balancing=0; THP=on; CPU governor=Performance; C2 states=disabled		

Table 1: AMD system configurations

TEST METHODOLOGY

SIMULIA, a Dassault Systèmes brand, provides a standard set of benchmarks that evaluate the performance of different platforms running SIMULIA applications, such as Abaqus/Explicit. These benchmark cases represent typical usage and cover a range of sizes. The uplift is calculated as the ratio of the systems under test (*sut*) to the reference system (*ref*). In this Summary Brief, the 3rd Gen AMD EPYC 7773X processor is the *ref* and the 4th Gen AMD EPYC 9384X and 9684X processors are the *sut*. The total amount of variability between individual runs was <1%. The results shown in this Performance Brief are the composite average results of the SIMULIA e13 (car crash) and e14 (drop test) models.

FOR ADDITIONAL INFORMATION

Please see the following additional resources for more information about 4th Gen AMD EPYC features, architecture, and available models:

- AMD EPYC™ 9004 Series Processors
- AMD EPYC™ Tuning Guides
- AMD EPYC™ Products

AUTHORS

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REFERENCES

1. "Technical Computing" or "Technical Computing Workloads" as defined by AMD can include: electronic design automation, computational fluid dynamics, finite element analysis, seismic tomography, weather forecasting, quantum mechanics, climate research, molecular modeling, or similar workloads. GD-204
2. AMD Infinity Guard features vary by EPYC™ Processor generations. Infinity Guard security features must be enabled by server OEMs and/or Cloud Service Providers to operate. Check with your OEM or provider to confirm support of these features. Learn more about Infinity Guard at https://www.amd.com/en/technologies/infinity-guard. GD-183
3. Based on calculated areal density and based on bump pitch between AMD hybrid bond AMD 3D V-Cache stacked technology ccompared to AMD 2D chiplet technology and Intel 3D stacked micro-bump technology. EPYC-026
4. Based on AMD internal simulations and published Intel data on "Foveros" technology specifications. EPYC-027
5. Maximum boost for AMD EPYC processors is the maximum frequency achievable by any single core on the processor under normal operating conditions for server systems. EPYC-18

RELATED LINKS

- SIMULIA Abaqus*
- AMD EPYC™ Processors
- AMD EPYC Technical Briefs

Links to third party sites are provided for convenience and unless explicitly stated, AMD is not responsible for the contents of such linked sites and no endorsement is implied.

AMD EPYC 9004 FOR FEA

4th Gen AMD EPYC CPUs deliver excellent per-core performance by taking advantage of fast CPU frequencies, low latency memory, and a unified cache structure. Design engineers can use AMD EPYC processors to perform complex computational design tasks with ground-breaking high-performance computing and robust security features to deliver excellent results.

"ZEN 4" CORE & SECURITY FEATURES

Support for up to:

- 96 physical cores, 192 threads
- 1152 MB of L3 cache per CPU
- 96 MB of L3 cache per CCD
- 6 TB of DDR5-4800 memory
- Up to 128 1P, up to 160 2P PCIe® Gen 5 lanes

Infinity Guard security features[2]

- Secure Boot
- Encrypted memory with SME

DASSAULT SYSTÈMES

Dassault Systèmes provides businesses and people with collaborative 3D virtual environments to imagine sustainable innovations. By creating virtual experience twins of the real world with its **3D**EXPERIENCE® platform and applications, customers of Dassault Systèmes push the boundaries of innovation, learning and production.

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