

POWERING ELECTRONIC HEALTHCARE SOFTWARE ELECTRONIC HEALTH RECORDS

Powered by 4th Gen AMD EPYC™ Processors

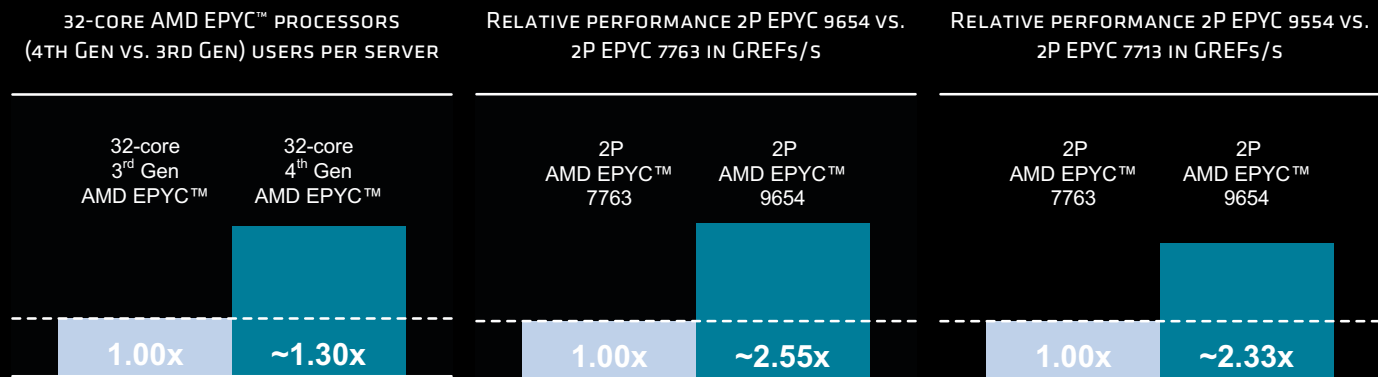
July 2023

AT A GLANCE

Testing performed by Epic Systems Corporation shows 4th Gen AMD EPYC™ general purpose processors delivering generational performance uplifts on their electronic health records software application.¹

PERFORMANCE HIGHLIGHTS

Epic testing showed 32-core 4th Gen AMD EPYC CPUs handling ~30% more users/server vs. 32-core 3rd Gen AMD EPYC CPUs for published application workloads. 32-core 4th Gen AMD EPYC 9354 CPUs outperform 32-core 3rd Gen AMD EPYC 7543 CPUs by ~1.94x in GREFs.



KEY TAKEAWAYS

Epic develops an integrated platform of modular electronic health records software that addresses multiple mission-critical aspects of healthcare systems. Epic testing showed 32-core 4th Gen AMD EPYC 9004 Series Processors supporting up to 30% more users per server for published application deployments compared to 32-core 3rd Gen AMD EPYC 7003 Series Processors. Further, 32-core 4th Gen AMD EPYC 9354 CPUs outperform 32-core 3rd Gen AMD EPYC 7543 CPUs by ~1.94x in Global References per Second (GREFs/s), and the top-of-stack 96-core 4th Gen AMD EPYC 9654 outperforms the 3rd Gen 64-core AMD EPYC 7763 by ~2.55x in GREFs/s.

4th Gen AMD EPYC processors feature:

- 1MB L2 cache vs. 512 KB in “Zen 3.”
- 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

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AMD EPYC™ 9004 PROCESSORS

4th Gen Series Processors™ continue the AMD history of x86 architecture innovations and [world-record](#) performance found in 3rd Gen AMD EPYC processors. Each general purpose AMD EPYC 9004 processor includes up to 96 cores running at high frequencies, high memory bandwidth and capacity, and up to 384MB of L3 cache to unleash exceptional performance.

AMD EPYC 9004 Series Processors are built on next-generation 5nm technology. They support 12 channels of high- performance DDR5 DIMMs with one or two DIMMS per channel (depending on OEM configuration), AVX512, and either 128 lanes (single-socket) or up to 160 lanes (dual-socket) of fast PCIe® Gen 5 I/O. These features address the demands of today's compute- and memory-intensive AI, ML, HPC, and in-memory workloads. They also natively support the increasing use of accelerators, GPUs, FPGAs, and high-capacity LAN cards. 4th Gen AMD EPYC processors raise the bar for datacenter performance on premises or in the cloud running bare metal, VM, or containerized workloads.

4th Gen AMD EPYC 9004 Series general purpose processors empower faster time-to-value by delivering performance and scalability, while also defending your data. AMD Infinity Guard allows your organization to enhance control of security and decrease risks to your most important assets – your data.²

AMD EPYC 9004 SERIES ARCHITECTURE QUICK LOOK

AMD EPYC 9004 Series general purpose processors continue the proven Multi-Chip Module (MCM) chiplet architecture found in previous AMD EPYC processor generations. The all-new “Zen 4” core is manufactured using a 5nm process and designed to provide a significant instructions per cycle (IPC) uplift over prior-generation 7nm “Zen 3” cores. Built-in Simultaneous Multi-Threading (SMT) support allows up to 2 threads per core. This means that each dual-socket system with two 4th Gen AMD EPYC 96-core processors offers 192 physical cores and up to 384 threads.

4th Gen AMD EPYC 9004 general purpose processors also include a generationally enlarged L3 cache that ranges up to 384MB/ CPU. This large cache facilitates cache sharing between the cores to a unified 32 MB of L3 cache per core chiplet die (CCD). This means that up to 8 cores per CCD can share 32 MB of unified L3 cache.

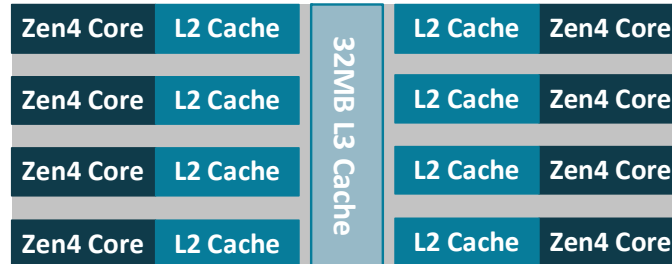


Figure 1: AMD EPYC 9004 Series Processor L3 cache layout

This proven L3 cache design can increase the cache hit to miss ratio over previous designs. Improved cache sharing also allows larger blocks to fit directly into the cache instead of falling into the main memory. Further, improved cache fetching and eviction policies manage data more efficiently. Combining the highly efficient cache found in 4th Gen AMD EPYC general purpose processors with the new “Zen 4” cores plus support for DDR5 memory enables a performance uplift on Epic compared to 3rd Gen AMD EPYC processors.

AMD EPYC 9004 SERIES CPU OPTIONS

4th Gen AMD EPYC general purpose processors come in multiple CPU configurations. Table 1 lists the key features of the 4th Gen AMD EPYC processors recommended for use with Epic. Of these, the 9xx4F models drive up per-core performance compared to other 9xx4 processors by offering the highest frequencies of their respective core counts.

MODEL	# CCDS	CORES/ THREADS	BASE FREQ (GHZ)	MAX BOOST FREQ ³ (UP TO GHZ)	DEFAULT TDP (W)	CTDP (W)	L3 CACHE (MB)	NODES PER SOCKET	1P/2P
9654	12	96/192	2.40	3.70	360	320-400	384	1/2/4	1P/2P
9554	8	64/128	3.10	3.75	360	320-400	256	1/2/4	1P/2P
9534	8	64/128	2.45	3.70	280	240-280	256	1/2/4	1P/2P
9374F	8	32/64	3.85	4.30	320	320-400	256	1/2/4	1P/2P
9354	8	32/64	3.25	3.80	280	240-280	256	1/2/4	1P/2P
9334	4	32/64	2.90	3.90	210	200-240	128	1/2/4	1P/2P
9274F	8	24/48	4.05	4.30	320	320-400	256	1/2/4	1P/2P
9254	4	24/48	2.90	4.15	200	200-240	128	1/2/4	1P/2P
9224	4	24/16	2.50	3.70	200	200-240	64	1/2/4	1P/2P
9174F	8	16/32	4.10	4.40	320	320-400	256	1/2/4	1P/2P
9124	4	16/32	3.00	3.70	200	200-240	64	1/2/4	1P/2P

Table 1: AMD EPYC 9004 SKU options

These recommendations span multiple core count configurations and both standard and High Frequency processors. Please contact your Epic technical representative for additional information. If you have an Epic UserWeb account, this information is also available in the Client Processor Guide.

INTERSYSTEMS IRIS® DATABASE TESTING RESULTS

The ODB server is the heart of the Epic product suite. Epic uses Chronicles running on the InterSystems IRIS® database to store and distribute patient record information to the rest of the systems. Epic tested servers powered by various sizes of AMD EPYC 9004 Series Processors to verify their efficiency and performance and to determine the scalability of database operations. These tests measure Global References per second (GREFs/s), and the results show how AMD EPYC 9004 Series Processors deliver the excellent performance and scalability needed to successfully manage critical patient information.

CPU	PHYSICAL CORE COUNT	RAM	STORAGE	HOST OS	VM OS	ISC DB VERSION	SIZING RESULT (MGREFS/S)
2P 9654	192	1536 GB	SAN-based SSD	VMware ESXi 8.0	RHEL 8.7/ Ubuntu 20.04	IRIS 2021.1	34.2 ^a
2P 9554	128	1536 GB	SAN-based SSD	VMware ESXi 8.0	RHEL 8.7/ Ubuntu 20.04	IRIS 2021.1	24.5 ^b
2P 9374F	64	1536 GB	SAN-based SSD	VMware ESXi 8.0	RHEL 8.7/ Ubuntu 20.04	IRIS 2021.1	14.2 ^c
2P 9354	64	1536 GB	SAN-based SSD	VMware ESXi 8.0	RHEL 8.7/ Ubuntu 20.04	IRIS 2021.1	13.0

Table 2: IRIS database performance comparing 4th Gen vs. 3rd Gen AMD EPYC processors

In Table 2:

- **a:** This is an uplift of ~2.55x the performance of the 2P AMD EPYC 7763 system.
- **b:** This is ~1.83x the performance of the 2P AMD EPYC 7763 system and an uplift of ~2.33x the performance of the 2P AMD EPYC 7713 system.
- **c:** This is an uplift of ~2.12x the performance of the AMD EPYC 7543 system.

FOR ADDITIONAL INFORMATION

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

[AMD EPYC™ Tuning Guides](#)

- [AMD EPYC™ Products](#)

REFERENCES

1. Epic performed the testing using their proprietary test suite and test environments and recorded the results, providing them to AMD for publication. While the testing and results have not been independently verified by AMD, AMD engineers believe the results to be reasonable.
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. 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

AUTHOR

Kyle Henry contributed to this Performance Brief.

RELATED LINKS

- [Epic*](#)
- [AMD EPYC Processors](#)
- [AMD EPYC Technical Briefs](#)

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AMD EPYC 9004 FOR HEALTHCARE

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. Strong performance plus robust security features make 4th Gen AMD EPYC processors the ideal choice for electronic healthcare systems and applications.

“ZEN 4” CORE & SECURITY FEATURES

Support for up to:

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

Infinity Guard security features²

- Secure Boot
- Encrypted memory with SME

AMD EPYC FOR EHR SOFTWARE

Epic has tested and validated 4th Gen AMD EPYC processors and added many of them to their list of recommended processors for use in its EHR software.

EPIC SYSTEMS CORPORATION

Epic Systems is one of the largest providers of health information technology, used primarily by large U.S. hospitals and health systems to access, organize, store and share electronic medical records. According to the company, hospitals that use its software held medical records of 78% of patients in the United States and over 3% of patients worldwide in 2022.

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