AMAZON EC2 M7A INSTANCES DELIVER STRONG VALUE
SURPASSING THE COMPETITION

Powered by 4th Gen AMD EPYC™ Processors

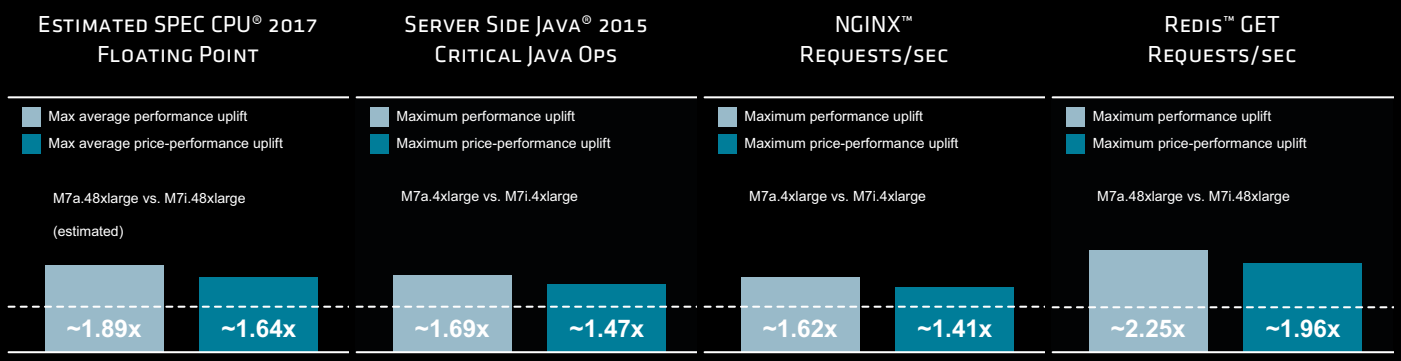
October 2023

AT A GLANCE

Amazon EC2 M7a instances powered by 4th Gen AMD EPYC™ processors deliver strong performance and price-performance uplifts compared to Amazon EC2 M7i instances powered by Intel® Xeon® Platinum processors on a variety of key workloads.[1]

PERFORMANCE HIGHLIGHTS

These charts highlight some of the max performance and price-performance uplifts of Amazon EC2 M7a instances powered by 4th Gen AMD EPYC processors normalized to equivalent-sized Amazon EC2 M7i instances powered by Intel Xeon Platinum processors. These charts show selected workload uplifts on varying instance sizes. Detailed results, including additional benchmarks, appear inside this brief.



AMAZON EC2 M7A INSTANCES

Amazon EC2 M7a instances are designed to deliver the best x86 performance and price performance within the Amazon EC2 general purpose family. M7a instances are powered by 4th-generation AMD EPYC processors with a maximum frequency of up to 3.70 GHz.[2] Per Amazon, these instances deliver up to 50% greater performance on average compared to Amazon EC2 M6a instances and offer new processor capabilities such as AVX-512, VNNI, and BFloat16.[3] This Performance Brief focuses on AMD EPYC-based M7a vs. Intel Xeon-basedM7i instances.[3]

Amazon EC2 M7a are available in a range of sizes from 1 vCPU core and 4 GiB memory to 192 vCPU cores and 768 GiB of memory with network bandwidth from 12.5 GiB to 50 GiB and 10-40 GiB of Elastic Block Store (EBS) bandwidth. All Amazon EC2 M7a instances feature DDR5 memory and deliver 2.25x more memory bandwidth compared to M6a instances to enable high-speed access to data in memory. M7a instances are built on the AWS Nitro System and are ideal for applications that benefit from high performance and high throughput such as financial applications, application servers, simulation modeling, gaming, mid-size data stores, application development environments, and caching fleets. See Introducing Amazon EC2 M7a Instances* and Amazon EC2 M7a Instances* to learn more.

IN THIS BRIEF

PERFORMANCE RESULTS ON KEY WORKLOADS

This section displays the performance uplifts of Amazon EC2 M7a instances powered by 4th Gen AMD EPYC processors versus Amazon EC2 M7i instances powered by Intel Xeon Platinum processors. All of the results presented in this section are the average of three test runs performed by AMD for each of the listed benchmarks/workloads. All of the charts in this section display the performance or price-performance uplifts between Amazon EC2 M7a instances normalized to the performance or price-performance of the equivalent-sized Amazon EC2 M7i instance, where the performance and price-performance of the equivalent Amazon EC2 M7i instance will always equal 1.00x. The testing, instance configurations, and pricing information used for price-performance comparisons was current for the US-EAST (Ohio) region as of September 23rd, 2023 and is subject to change. Please visit Amazon EC2 pricing* and the AWS Cost Calculator* for the most recent instance pricing information.

INTEGER AND FLOATING-POINT PERFORMANCE

The SPEC CPU® 2017 benchmark is one of the most popular industry standard benchmarks historically designed to provide performance measurements that can be used to compare compute-intensive workloads by stressing the processor, memory subsystem, and compiler on different computer systems. SPEC CPU 2017 contains 43 benchmarks organized into four suites of which two, SPECrate® 2017 Integer, and SPECrate® 2017 Floating Point, are discussed in this Performance Brief. Figures 1-4 show the estimated SPECrate® 2017 Integer and SPECrate® 2017 Floating Point performance and price-performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances, respectively, with all results normalized to the M7i instances.

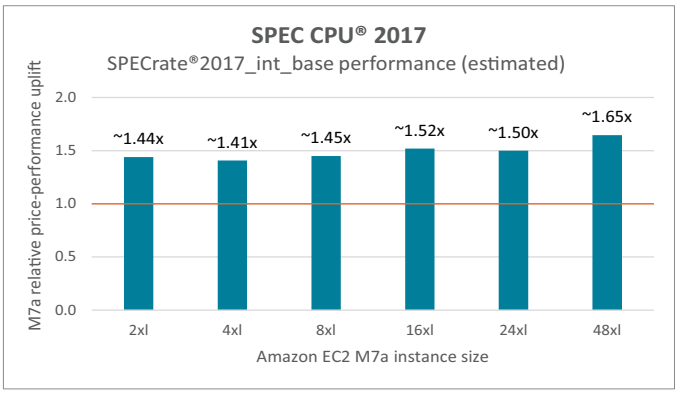


Figure 1: Amazon EC2 M7a vs. M7i SPECrate®2017_int_base performance uplift (estimated)

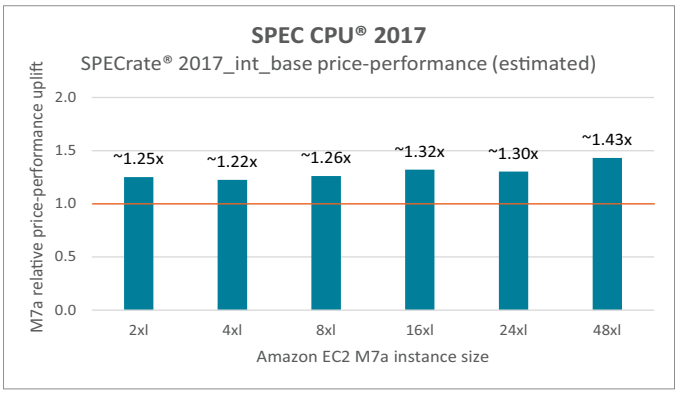


Figure 2: Amazon EC2 M7a vs. M7i SPECrate®2017_int_base price-performance uplift (estimated)

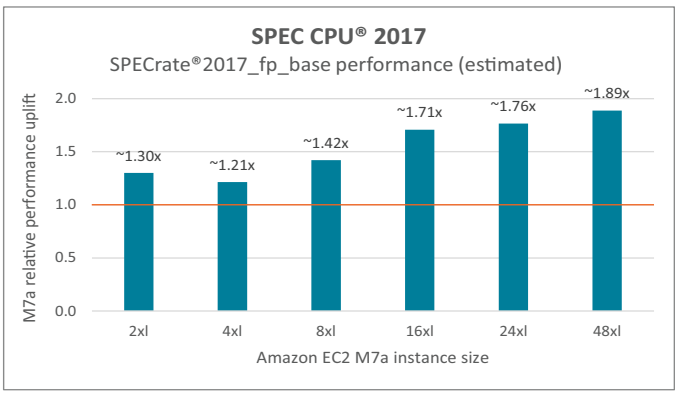


Figure 3: Amazon EC2 M7a vs. M7i SPECrate®2017_fp_base performance uplift (estimated)

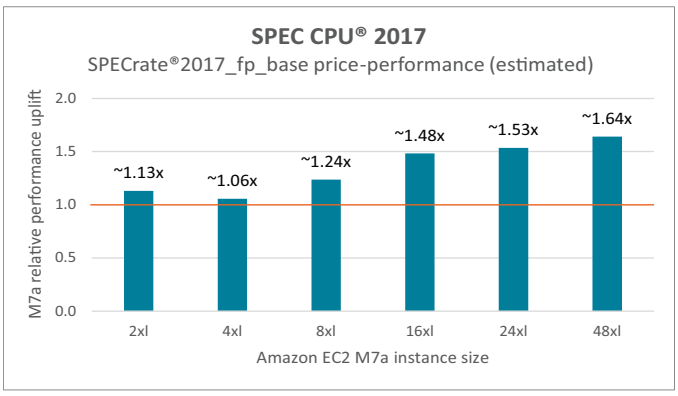


Figure 4: Amazon EC2 M7a vs. M7i SPECrate®2017_fp_base price-performance uplift (estimated)

JAVA PERFORMANCE

The Server Side Java® 2015 benchmark enables performance measurements of server-side Java® based applications. Server Side Java® simulates a company with an IT infrastructure that handles a mix of point-of-sale requests, online purchases, and data-mining operations. With the rapid adoption of Java across the industry in the last two decades, this benchmark is relevant to all audiences including Java Virtual Machine (JVM) vendors, hardware developers, Java application developers, researchers, and members of the academic community. Figures 5-8 show Server Side Java 2015 single- and multiple-instance performance and price-performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances, respectively, with all results normalized to the M7i instances.

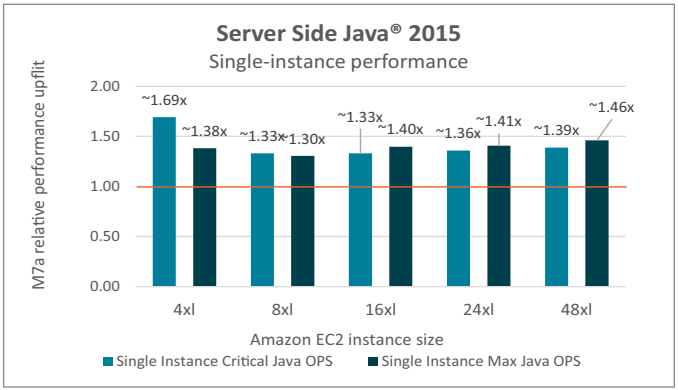


Figure 5: Amazon EC2 M7a vs. M7i Server Side Java 2015 Single-instance performance uplift

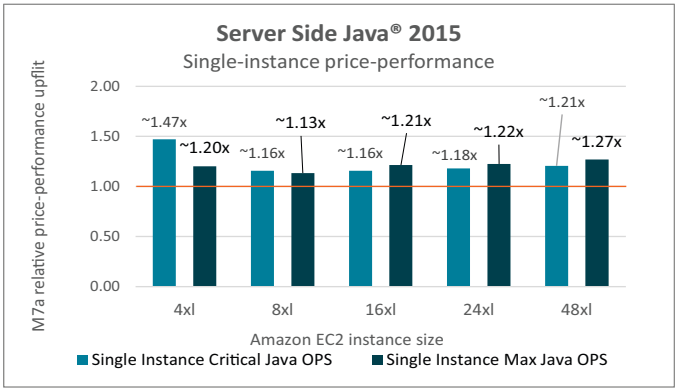


Figure 6: Amazon EC2 M7a vs. M7i Server Side Java 2015 Single-instance price-performance uplift

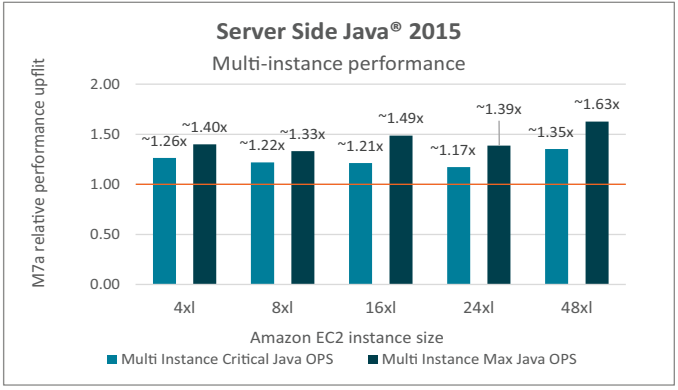


Figure 7: Amazon EC2 M7a vs. M7i Server Side Java 2015 Multi-instance performance uplift

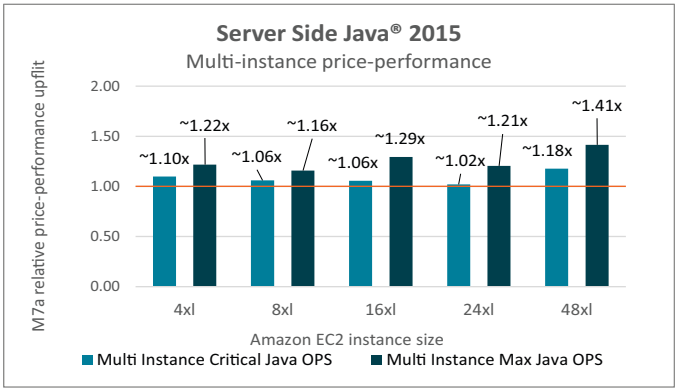


Figure 8: Amazon EC2 M7a vs. M7i Server Side Java 2015 Multi-instance price-performance uplift

WEB SERVER PERFORMANCE WITH NGINX™

NGINX™ is a popular web server that can also be used as a reverse proxy, load balancer, mail proxy, and HTTP cache. AMD tested NGINX throughput in connections per second as a high-performance web server in conjunction with the WRK web (http) client. These tests used a single NGINX server instance on a single M7a or M71 instance. Testing retained key NGINX server parameters at their default values, including the number of worker processes and cache manager/loader. Figures 9 and 10 showcase the performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances in requests per second (rps) achieved and the price-performance uplifts of these instances, respectively, with all results normalized to the M7i instances.

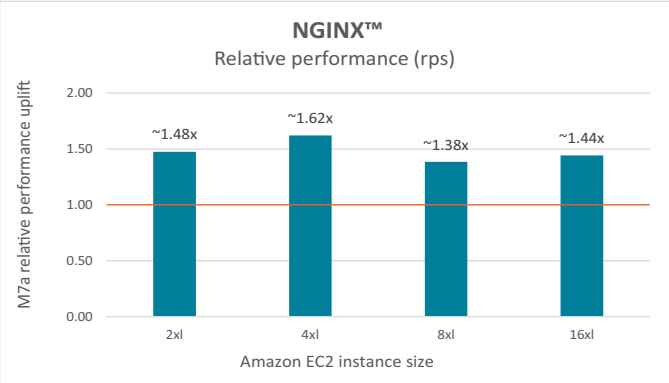


Figure 9: Amazon EC2 M7a vs. M7i NGINX performance uplift

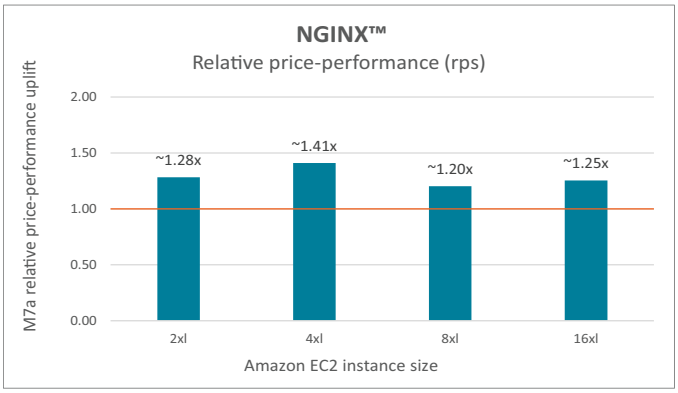


Figure 10: Amazon EC2 M7a vs. M7i NGINX price-performance uplift

MYSQL TPROC-C

TPC Benchmark C™ is an on-line transaction processing (OLTP) benchmark that defines a set of functional requirements that can be run on any transaction processing system, regardless of hardware or operating system. The HammerDB benchmark tool was used to build and generate the TPROC-C workload. The HammerDB TPROC-C workload is an open-source workload derived from the TPC-C™ Benchmark Standard and as such is not comparable to published TPC-C results, as the results do not comply with the TPC-C Benchmark Standard. Figures 11 and 12 showcase the Amazon EC2 M7a instance performance uplifts versus Amazon EC2 M7i instances in transactions per second (tpm) achieved and the price-performance uplifts of these instances, respectively, with all results normalized to the M7i instances.

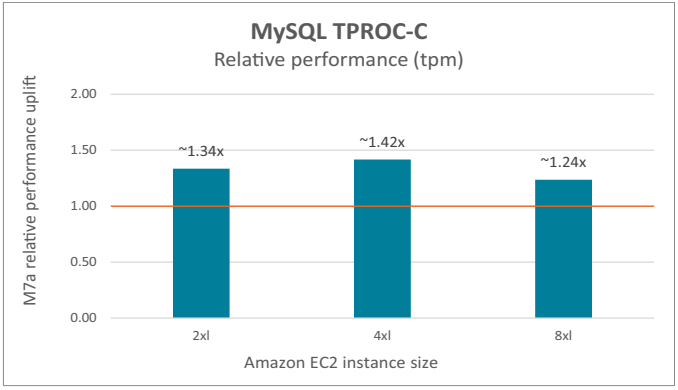


Figure 11: Amazon EC2 M7a vs. M7i MySQL TPROC-C performance uplifts

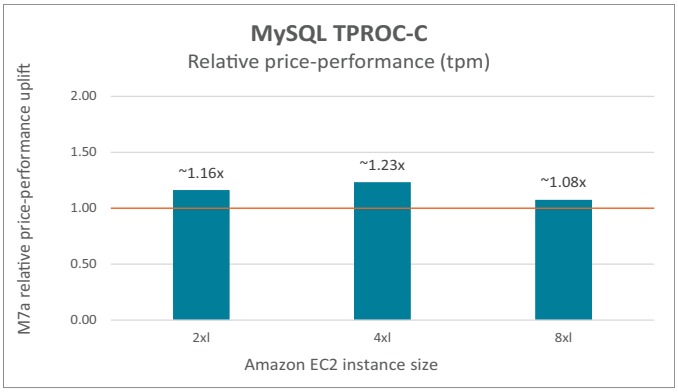


Figure 12: Amazon EC2 M7a vs. M7i MySQL TPROC-C price-performance uplifts

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Relational Database Management Systems (RDBMS) continue to be the foundation for business-critical applications. HammerDB is a decision support benchmark that executes complex queries that require processing large volumes of data. The HammerDB TPROC-H workload is an open source workload derived from the TPC-H Benchmark Standard and as such is not comparable to published TPC-H results, as the results do not comply with the TPC-H Benchmark Standard.

MS SQL Server is able to support a full TPROC-H workload. Figures 13 and 14 showcase the performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances across several TPROC-H metrics running on MS SQL Server and the price-performance uplifts of these instances, respectively, with all results normalized to the M7i instances.

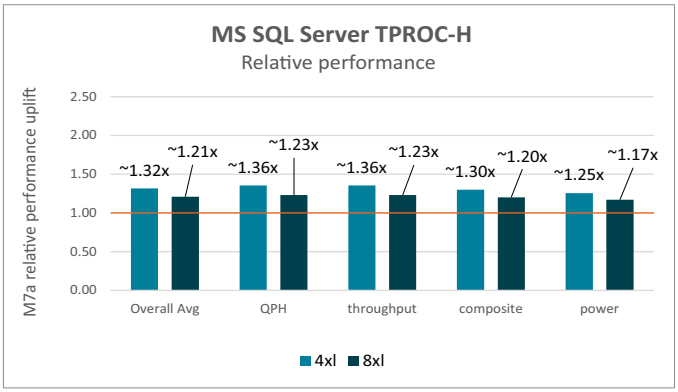


Figure 13: Amazon EC2 M7a vs. M7i MS SQL Server TPROC-H performance uplifts

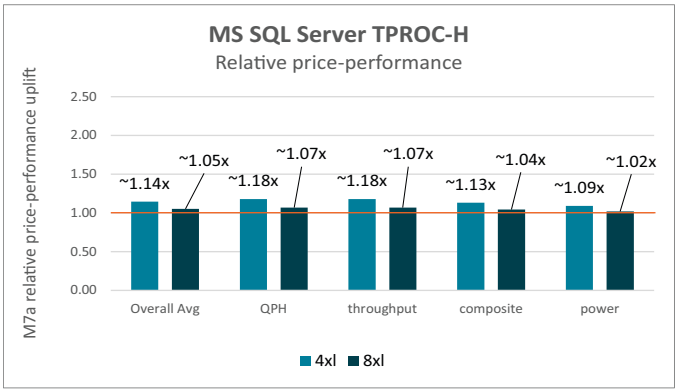


Figure 14: Amazon EC2 M7a vs. M7i MS SQL Server TPROC-H price-performance uplifts

IN-MEMORY DATABASE PERFORMANCE WITH REDIS™

Redis™ is an in-memory data structure store used as a distributed, in-memory key–value database, cache, and message broker, with optional durability. Redis supports different kinds of abstract data structures, such as strings, lists, maps, sets, sorted sets, HyperLogLogs, bitmaps, streams, and spatial indices. Redis works with an in-memory dataset to achieve top performance. Depending on the use case, Redis can persist the data either by periodically dumping the dataset to disk or by appending each command to a disk-based log. Figures 15-18 show the Redis 2015 GET and SET performance and price-performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances, respectively, with all results normalized to the M7i instances.

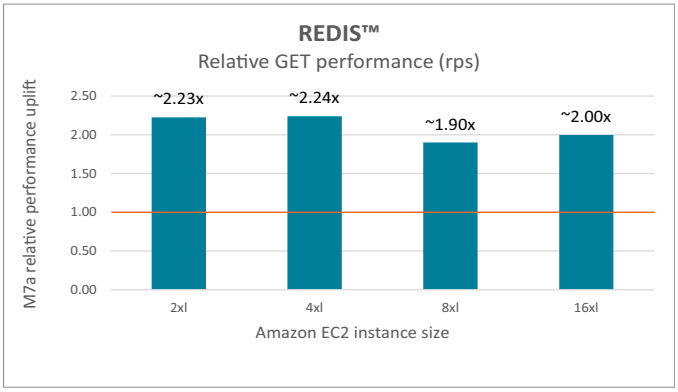


Figure 15: Amazon EC2 M7a vs. M7i Redis GET performance uplift

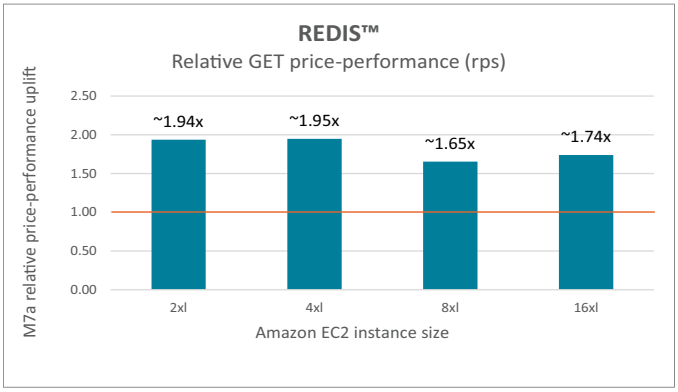


Figure 16: Amazon EC2 M7a vs. M7i Redis GET price-performance uplift

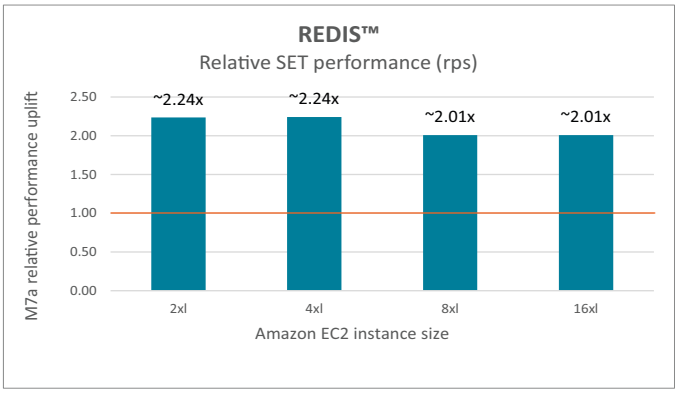


Figure 17: Amazon EC2 M7a vs. M7i Redis SET performance uplifts

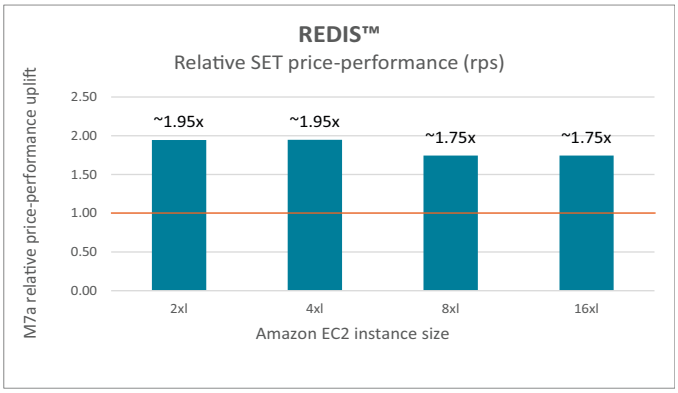


Figure 18: Amazon EC2 M7a vs. M7i Redis SET price-performance uplifts

FFMPEG

FFmpeg is a multimedia framework that can encode, decode, transcode, stream, filter and play just about any type of video in virtually any format, from legacy to ultramodern. FFmpeg works on a wide variety of operating systems, environments, and configurations. Figures 21-23 showcase the performance uplifts of Amazon EC2 M7a instances versus Amazon EC2 M7i instances running FFmpeg encoding and transcoding jobs and the price-performance uplifts of these instances, respectively, with all results normalized to the M7i instances.

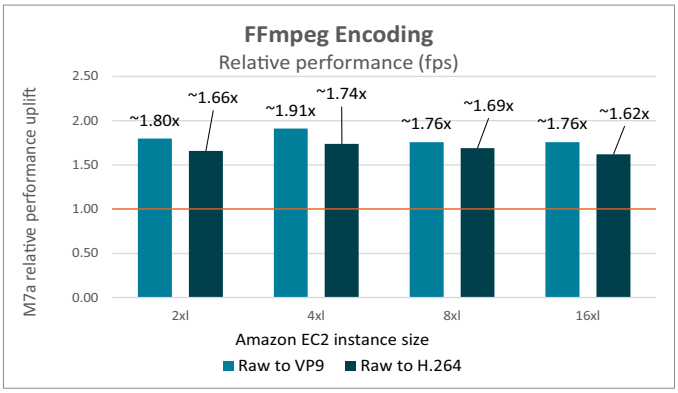


Figure 19: Amazon EC2 M7a vs. M7i FFmpeg encode performance uplifts

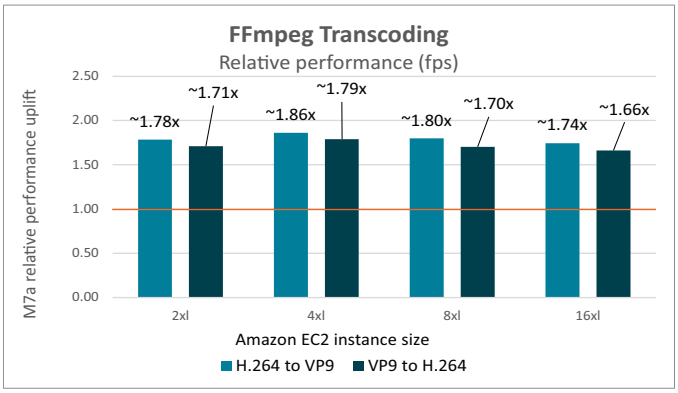


Figure 20: Amazon EC2 M7a vs. M7i FFmpeg transcode performance uplifts

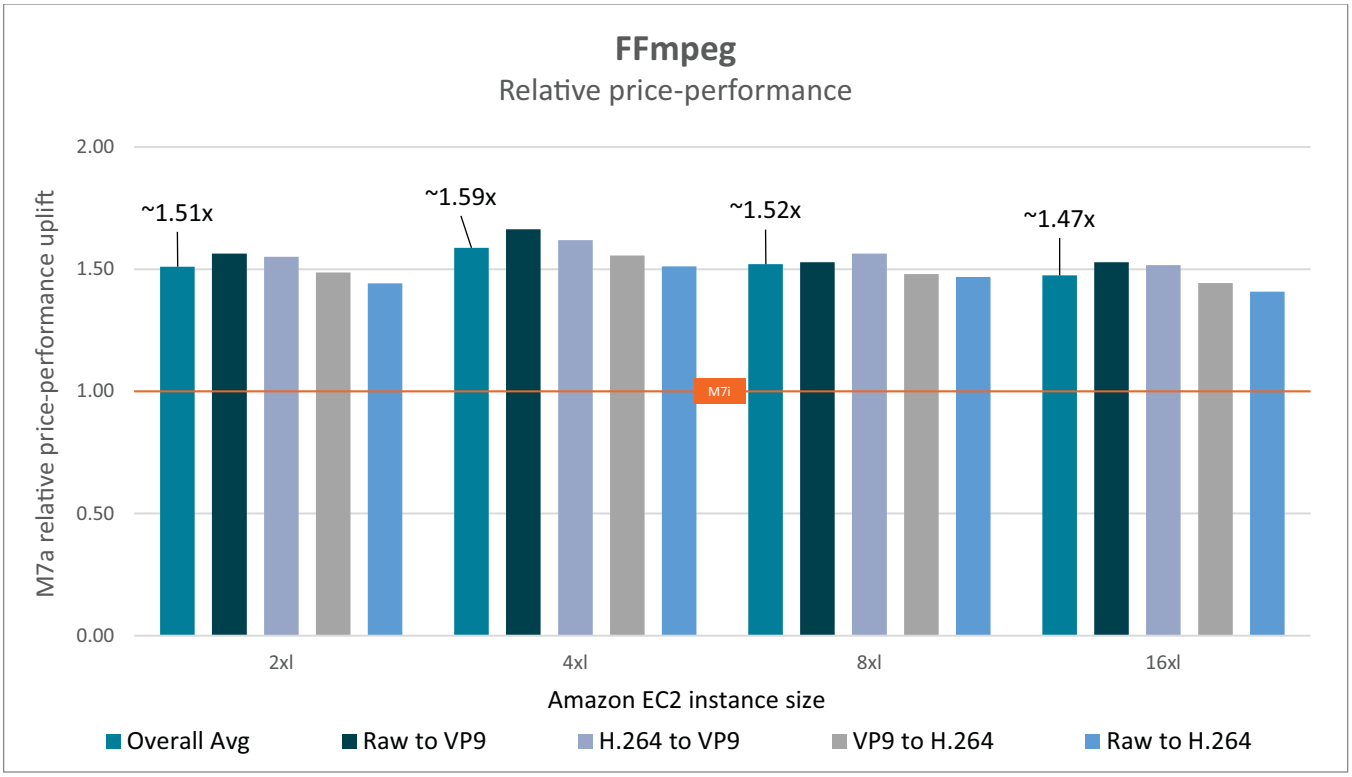


Figure 21: Amazon EC2 M7a vs. M7i FFmpeg price-performance uplifts

AMD EPYC 9004 SERIES PROCESSORS

AMD EPYC 9004 Series Processors continue to redefine processor standards for modern datacenters. 4th Gen AMD EPYC processors are built on the innovative x86 architecture and "Zen 4" core. 4th Gen AMD EPYC processors deliver efficient, optimized performance by combining high frequencies, the largest-available L3 cache, 128 lanes of PCIe® 5 I/O, and synchronized fabric and memory clock speeds, plus support for up to 6 TB of DDR5-4800 memory. Built-in security features, such as AMD Infinity Guard technology, Secure Memory Encryption (SME), and Secure Encrypted Virtualization (SEV-SNP) help protect data while it is in use.[4]

INSTANCE CONFIGURATIONS

Table 1 shows the available Amazon EC2 M7a instance configuration options as of October, 2023 when this Performance Brief was published. Please see Amazon EC2 M7a Instances for current information.

SIZE	vCPU	MEMORY (GIB)	STORAGE (GB)	NETWORK (GBPS)	EBS (GBPS)
m7a.medium	1	4	EBS-Only	Up to 12.5	Up to 10
m7a.large	2	8	EBS-Only	Up to 12.5	Up to 10
m7a.xlarge	4	16	EBS-Only	Up to 12.5	Up to 10
m7a.2xlarge	8	32	EBS-Only	Up to 12.5	Up to 10
m7a.4xlarge	16	64	EBS-Only	Up to 12.5	Up to 10
m7a.8xlarge	32	128	EBS-Only	12.5	10
m7a.12xlarge	48	192	EBS-Only	18.75	15
m7a.16xlarge	64	256	EBS-Only	25	20
m7a.24xlarge	96	384	EBS-Only	37.5	30
m7a.32xlarge	128	512	EBS-Only	50	40
m7a.48xlarge	192	768	EBS-Only	50	40
m7a.metal-48xl	192	768	EBS-Only	50	40

Table 1: Amazon EC2 M7a instance sizes

Table 2 shows the available Amazon EC2 M7i instance configuration options as of the date this Performance Brief was published. Please see Amazon EC2 M7i Instances for current information.

SIZE	vCPU	MEMORY (GIB)	STORAGE (GB)	Network (Gbps)	EBS (GBPS)
m7i.large	2	8	EBS-Only	Up to 12.5	Up to 10
m7i.xlarge	4	16	EBS-Only	Up to 12.5	Up to 10
m7i.2xlarge	8	32	EBS-Only	Up to 12.5	Up to 10
m7i.4xlarge	16	64	EBS-Only	Up to 12.5	Up to 10
m7i.8xlarge	32	128	EBS-Only	12.5	10
m7i.12xlarge	48	192	EBS-Only	18.75	15
m7i.16xlarge	64	256	EBS-Only	25	20
m7i.24xlarge	96	384	EBS-Only	37.5	30
m7i.48xlarge	192	768	EBS-Only	50	40
m7i.metal-24xl	96	384	EBS-Only	37.5	30
m7i.metal-48xl	192	768	EBS-Only	50	40

Table 2: Amazon EC2 M7i instance sizes

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 Documentation Hub
- AMD EPYC™ Products

REFERENCES

1. Testing performed in August and September, 2023. Cloud performance results presented are based on the test date in the configuration and are in alignment with AMD internal bare-metal testing factoring in cloud service provider overhead. Results may vary due to changes to the underlying configuration, and other conditions such as the placement of the VM and its resources, optimizations by the cloud service provider, accessed cloud regions, co-tenants, and the types of other workloads exercised at the same time on the system.
2. 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
3. Please see the M7a tab at https://aws.amazon.com/ec2/instance-types/m7a/*.
4. 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

AUTHORS

Mike Thompson and Anthony Hernandez contributed to this Performance Brief.

RELATED LINKS

- Amazon EC2 M7a Instances*
- Elastic Fabric Adapter*
- Amazon FSx for Lustre*
- AWS ParallelCluster*
- AWS Nitro System*
- AMD EPYC™ Processors and the AMD Documentation Hub

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BOOST PERFORMANCE WITH 4TH GEN AMD EPYC

Amazon EC2 M7a instances are powered by 4th Gen AMD EPYC processors and offer up to 192 CPU cores, 768 GB of high-bandwidth DDR5 memory, and 300 Gbps of Elastic Fabric Adapter (EFA) network bandwidth for fast, low-latency inter-node communications. These instances offer efficient scaling and are ideal for applications that benefit from high performance and high throughput such as financial applications, application servers, simulation modeling, gaming, mid-size data stores, application development environments, and caching fleets.

AMD EPYC 9004 FOR GENERAL COMPUTING

4th Gen AMD EPYC processors deliver blazing per-core performance thanks to fast CPU frequencies and low latency memory. AMD EPYC processors provide high bandwidth between nodes with support for PCIe® Gen 5 network devices and accelerators that greatly benefit general computing applications.

AMAZON EC2 M7A INSTANCES

Amazon EC2 M7a instances are SAP-certified and ideal for applications that benefit from high performance and high throughput such as financial applications, application servers, simulation modeling, gaming, mid-size data stores, application development environments, and caching fleets.

DISCLAIMERS

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