**AMD EPYC™ 7371 Processors**

**Accelerating HPC Innovation**

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**Exceptional Memory Bandwidth**
AMD EPYC server processors deliver 8 channels of memory with support for up to 2TB of memory per processor.

**Standards Based**
AMD is committed to industry standards, offering you a choice in x86 processors with design innovations that target the evolving needs of modern datacenters.

**No Compromise Product Line**
Compute requirements are increasing, datacenter space is not. AMD EPYC server processors offer up to 32 cores and a consistent feature set across all processor models.

**Power HPC Workloads**
Tackle HPC workloads with leading performance and expandability. Accelerate your workloads with up to 33% more PCI Express® Gen 3 lanes.

**Optimize Productivity**
Increase productivity with tools, resources, and communities to help you "code faster, faster code." Boost application performance with Software Optimization Guides and Performance Tuning Guidelines.

**Security in the Datacenter**
Help safeguard your software and data with the industry’s first x86 processor with an embedded security processor.

**Partner Ecosystem**
AMD’s broad partner ecosystem and collaborative engineering provide tested and validated solutions that help lower your risk and total cost of ownership.

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**AMD EPYC 7371 processors (16 core, 3.1GHz):**

**The right choice for HPC**

Designed from the ground up for a new generation of solutions, AMD EPYC™ 7371 processors (16 core, 3.1GHz) implement a philosophy of choice without compromise. The AMD EPYC 7371 processor delivers outstanding frequency for applications sensitive to per-core performance such as those licensed on a per-core basis.

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AMD EPYC 7371 processors are an excellent option when license costs dominate the overall solution cost. In these scenarios the performance-per-dollar of the overall solution is usually best with a CPU that can provide excellent per-core performance.

AMD EPYC processors’ innovative architecture translates to tremendous performance. More importantly, the performance you’re paying for can be matched to the appropriate to the performance you need.

I/O intensive workloads can utilize the plentiful I/O bandwidth with the right number of cores – avoiding overpaying for unneeded power – while compute-intensive workloads can make use of fully loaded core counts, dual sockets and plenty of memory.

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**Expanding the AMD EPYC™ 7001 Series Processor Product Stack**

The addition of the AMD EPYC 7371 processor further completes the AMD EPYC 7001 series processor product stack. This processor fits right in between the AMD EPYC™ 7451 processors (24-core, 2.3GHz) and the AMD EPYC™ 7351 processor (16-core, 2.4GHz). This processor is perfect for those that require excellent per-core memory bandwidth and excellent per-core performance. The AMD EPYC 7371 processor has an
all-core boost frequency that is 24% higher than the AMD EPYC 7351 processor, all while maintaining the same number of cores, the same memory bandwidth, and the same number of PCIe® Gen3 lanes.

**Positioning the AMD EPYC 7371 processor (16 core, 3.1GHz)**

Table 1 shows the full AMD EPYC 7001 series processor product stack.

<table>
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<tr>
<th>Model Number</th>
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<th>L3 $ (MB)</th>
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</table>

*Table 1: The AMD EPYC 7001 Series Processor Product Stack*

**Why AMD EPYC 7371 processor and why now?**

AMD is constantly listening to customer feedback and reacting to shifts in the market. A need was identified for customers who are after high per-core performance all while retaining the other great features of AMD EPYC processors, such as the excellent memory bandwidth or the excellent I/O scalability.

There are many scenarios in which this is important. An example would be an application that is licensed on a per-core basis. In these scenarios, AMD EPYC 7371 processors provide excellent compute performance, while keeping the licensing costs down to help ensure the customer is getting the optimal value for each dollar invested in software licensing.
Performance Benchmarks and Testing

Benchmarks were performed across a wide range of applications and different types of workloads to show the performance benefits of AMD EPYC 7371 processors. The testing includes examples of CFD, FEA, Weather, and Molecular Dynamics applications.

The purpose of the benchmarks is to show the relative performance of different AMD EPYC server processors to help customers better decide the right choice for their use case.

Benchmarks were performed across the following applications and workloads.

- ANSYS Fluent®
- WRF
- NAMD
- LSTC LS-DYNA®
- Altair Radioss®
- ESI PAM-CRASH®
- Siemens PLM Star-CCM+®

Tested Hardware/Software configuration

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<tr>
<th>Compute Nodes</th>
<th></th>
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<tr>
<td>CPUs</td>
<td>2 x AMD EPYC 7351 processors (16-core, 2.4GHz) / 2 x AMD EPYC 7371 processors (16-core, 3.1GHz) / 2 x AMD EPYC 7451 processors (24-core, 2.3GHz)</td>
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<tr>
<td>Memory</td>
<td>256GB (16x 16GB Dual-Rank DDR4-2666 DIMMs)</td>
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<td>NIC</td>
<td>Mellanox ConnectX-5 EDR 100Gb Infiniband x16 PCIe</td>
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<tr>
<td>Storage: OS</td>
<td>1 x 256 GB NVMe</td>
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<tr>
<td>Storage: Data</td>
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<table>
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<td>OS</td>
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Configuration Options

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<th>SVM=Disabled</th>
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**ANSYS FLUENT: AMD EPYC 7371 Processors vs Intel Xeon Gold 6148 Processors**

Performance was compared across 11 different ANSYS FLUENT benchmarks using AMD EPYC 7371 processor and Intel Xeon Gold 6148 processors (20 core, 2.4GHz). The Intel data was gathered from published results on the ANSYS website. We have compared relative system level performance as well as relative per core performance.

AMD EPYC 7371 processors deliver an up to 5% average lead in overall system performance across all benchmarks. Even more impressive leads were posted in per-core performance, by up to 49%, with an average of up to 32% across all benchmarks. Per-core performance is critically important to maximize software license investments.

**Per Core Performance**

Figure 2 shows the per core performance where AMD EPYC 7371 processors win by a large margin over Intel Xeon Gold 6148 processors.

Per core performance is critical in workloads where licensing may be charged on a per core basis.

![Relative Average Per Core Performance - AMD EPYC 7371 vs Intel Xeon Gold 6148](image_url)

*Figure 1*
System Level Performance

Figures 2 shows the relative system level performance across the ANSYS FLUENT benchmarks. AMD EPYC 7371 processors post an up to 5% average lead in overall system performance across all benchmarks in single node testing.
AMD EPYC Server Processors: High Frequency vs. Core-Count

The following charts show relative performance of the high frequency AMD EPYC 7371 processor vs. two other AMD EPYC server processors across a range of different applications. The AMD EPYC 7351 processor has the same core count of 16 cores. The AMD EPYC 7451 processor has 24 cores. Both processors are lower frequency than the AMD EPYC 7371 processor.

Software license pricing strategies require investigation into per-core performance to help ensure the customer is optimizing the software license investment. Higher per-core performance for per-core licensed software yields better performance-per-dollar on the overall solution compared to higher system level performance but having to pay more to license a larger core count system.

In contrast, there are applications that do not require licensing. In these scenarios, better overall system level performance would lead to better performance-per-dollar for the overall solution.

Each use case is different, and an analysis is recommended to find the right balance between per-core performance and system-level performance.
Weather Research and Forecasting (WRF)

Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

Relative System Level Performance (Mean ratio - higher is better)

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

Relative Per Core Performance (Mean ratio - higher is better)
Biophysics (NAMD)

Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451
Finite Element Analysis (LSTC LS-DYNA)

Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

- **neon**
  - AMD EPYC 7351 processors (16-core, 2.4GHz)
  - AMD EPYC 7371 processors (16-core, 3.1GHz)
  - AMD EPYC 7451 processors (24-core, 2.3GHz)

- **3cars**

- **car2car**

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

- **neon**
  - AMD EPYC 7351 processors (16-core, 2.4GHz)
  - AMD EPYC 7371 processors (16-core, 3.1GHz)
  - AMD EPYC 7451 processors (24-core, 2.3GHz)
Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

Relative System Level Performance (Elapsed Time ratio - higher is better)

- neon
- t10m

- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

Relative Per Core Performance (Elapsed Time ratio - higher is better)

- neon
- t10m

- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)
Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)
**Multidisciplinary Engineering Simulation (CD-adapco® STAR-CCM+®)**

Relative System Level Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

![Bar chart showing relative system level performance between EPYC 7351, 7371, and 7451 processors.](image)

Legend:
- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)

Relative Per Core Performance EPYC 7351 vs EPYC 7371 vs EPYC 7451

![Bar chart showing relative per core performance between EPYC 7351, 7371, and 7451 processors.](image)

Legend:
- AMD EPYC 7351 processors (16-core, 2.4GHz)
- AMD EPYC 7371 processors (16 core, 3.1GHz)
- AMD EPYC 7451 processors (24-core, 2.3GHz)
Summary

Benchmarks were conducted on single-node, two-socket systems using AMD EPYC 7371 processors, AMD EPYC 7351 processors, and AMD EPYC 7451 processors to show where the AMD EPYC 7371 processor fits in the lineup and its advantages. The AMD EPYC 7371 processor with its high frequency excels when looking for per-core performance, while the AMD EPYC 7451 processor, with its higher core count, delivers slightly better overall system-level performance.

Conclusion

Overall the AMD EPYC processor lineup has many parts that excel in HPC workloads and each part has its unique advantages when deciding which part is best for your use case.

The AMD EPYC 7371 processor has an advantage when software licensing is priced on a per-core basis because the AMD EPYC 7371 processor delivers the best per-core performance compared to the EPYC 7451 and EPYC 7351 processors. When looking for overall best system level performance in situations where there are no licensing costs the AMD EPYC 7451 processor delivers the best system performance.

Customers are encouraged to analyze their requirements and their licensing costs to best determine which AMD EPYC processor is best for their HPC deployment.

For more information about AMD EPYC server processors visit: https://www.amd.com/en/products/epyc-server

Authors

This paper is authored by Anre Kashyap in collaboration with Marc Baker, Kevin Mayo, and Andy Parma.

Footnotes


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