

# SIEMENS SIMCENTER STAR-CCM+™ ON AMAZON EC2 HPC6A INSTANCES FEATURING AMD EPYC™ 7003 SERIES PROCESSORS

## COMPUTATIONAL FLUID DYNAMICS

3rd Gen AMD EPYC™ processors deliver outstanding scale-out performance running Siemens® Simcenter STAR-CCM+™ on Amazon Web Services Hpc6a instances.

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### AMD EPYC™ 7003 SERIES PROCESSORS

AMD EPYC™ 7003 Series Processors redefine the standards for the modern datacenter. 3rd Gen AMD EPYC processors are built on the innovative x86 architecture and “Zen3” core. 3rd Gen AMD EPYC processors improve efficiency and optimize performance by combining higher frequencies, up to 256MB of L3 cache, 128 lanes of PCIe® 4 I/O, and synchronized fabric and memory clock speeds, plus support for up to 4TB of DDR-3200 memory. Built-in security features, such as AMD Infinity Fabric™, Secure Memory Encryption (SME), and Secure Encrypted Virtualization (SEV-SNP) help protect data while it is in use.<sup>1</sup> AMD EPYC 7003 Series Processors are designed to bring faster time-to-value along with performance, security, and scalability.

### AMAZON EC2 HPC6A INSTANCES POWERED BY 3RD GEN AMD EPYC PROCESSORS

Amazon EC2 Hpc6a instances are designed to offer the best price performance for compute-intensive, high-performance computing (HPC) workloads. Amazon EC2 Hpc6a instances feature AMD EPYC™ 7003 Series Processors built on a 7nm process node for increased efficiency with up to 3.6 GHz max boost frequency<sup>2</sup> and 384 GB RAM. The elasticity and scalability of AWS with the Amazon EC2 Hpc6a instances gives you optimal Amazon EC2 price-performance for scaling workloads such as computational fluid dynamics, weather forecasting, and molecular dynamics.<sup>3</sup>

### CFD WITH SIMCENTER STAR-CCM+™ ON AMAZON EC2 HPC6A INSTANCES

Siemens® Digital Industries Software distributes the Simcenter STAR-CCM+™ multiphysics computational fluid dynamics (CFD) application for simulating product operation under real-world conditions. Simcenter STAR-CCM+ uniquely brings automated design exploration and optimization to the CFD simulation toolkit of every engineer.<sup>4</sup> The Amazon EC2 Hpc6a's exceptional memory bandwidth powered by AMD EPYC 7003 processors delivers high performance for CFD applications, such as Simcenter STAR-CCM+.<sup>4</sup>

Technology  
Partner

Digital Industries  
Software

SIEMENS

#### PURPOSE BUILT FOR HPC WORKLOADS

Amazon EC2 Hpc6a instances offer the latest generation AWS Nitro cards and 100 Gbps Elastic Fabric Adapter networking for inter-node communications. You can also use Amazon FSx for Lustre for sub-millisecond latencies, hundreds of GB/s of storage throughput, and AWS Parallel Cluster to provision Amazon EC2 Hpc6a instances alongside other instance types within the same cluster.<sup>3</sup>

#### AMD EPYC 7003 FOR HPC

3rd Gen AMD EPYC processors deliver the industry's highest per-core performance<sup>5</sup> thanks to fast CPU frequencies, lower latency memory, and a unified cache structure. AMD EPYC processors provide high bandwidth between nodes with support for PCIe Gen 4 network devices and accelerators that greatly benefit HPC applications.

#### SIEMENS®

Siemens focuses on industry, infrastructure, transport, and healthcare. Siemens creates technologies for more resource-efficient factories, resilient supply chains, and smarter buildings and grids, cleaner and more comfortable transportation, and advanced healthcare to add real value for customers.

#### SIMCENTER STAR-CCM+™

Simcenter STAR-CCM+™ is a leading computational fluid dynamics (CFD) software for fast, accurate simulation of almost any engineering problem that involves the fluids, structures, and all the associated physics. The single integrated environment includes everything from CAD, automated meshing, multiphysics CFD, sophisticated post-processing, and design exploration.<sup>4</sup>

This performance brief displays Simcenter STAR-CCM+ 2020.3 strong scaling running a standard suite of benchmarks on Amazon EC2 Hpc6a instances featuring AMD EPYC 7003 Series Processors. Each instance includes 96 physical cores with AMD Simultaneous Multithreading [SMT] disabled and a 100 Gbps Elastic Fabric Adapter networking for fast inter-node communication that supports scaling from 1 to 16 instances. Tables 1 and 2 provide detailed test configuration information.

Figures 1 and 2 illustrate Simcenter STAR-CCM+ linear strong scaling on Amazon EC2 Hpc6a instances using the standard benchmark suite. Each Amazon EC2 Hpc6a instance has 96 physical cores.

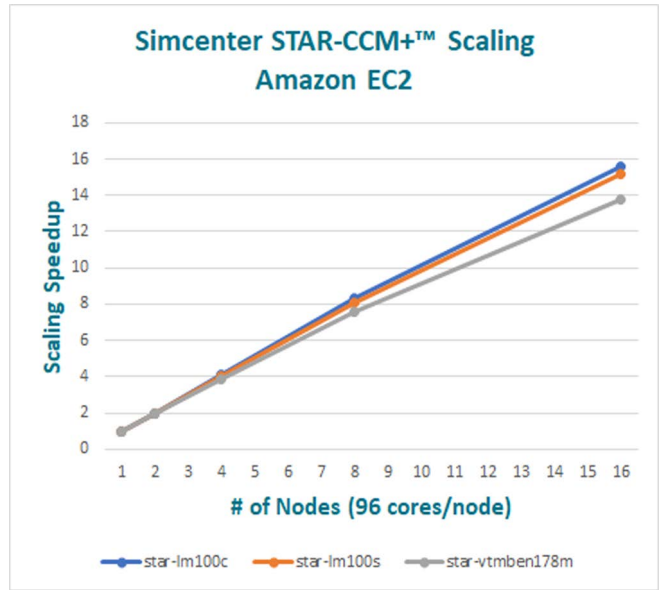
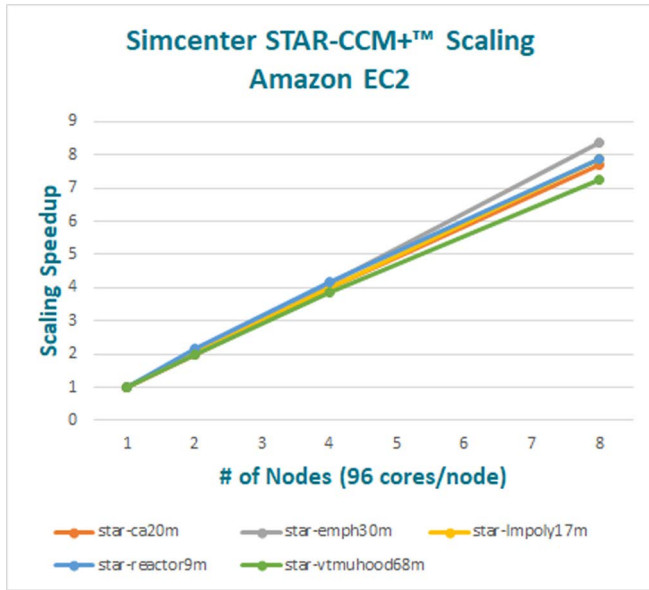


Figure 1: Simcenter STAR-CCM+ linear scale-out performance on smaller models with 8 Amazon EC2 Hpc6a instances

Figure 2: Simcenter STAR-CCM+ linear scale-out performance on larger models with 16 Amazon EC2 Hpc6a instances

For the larger models, Simcenter STAR-CCM+ generally exhibits predictable scaling through 16 instances by delivering an average speed up of ~15x at sixteen instances (1536 cores). For the smaller models, the average speedup is nearly 8x at eight instances (768 cores).

## AMAZON EC2 HPC6A INSTANCE CONFIGURATION

SOFTWARE	
Solver	Simcenter STAR-CCM+ 2020.3
MPI	OpenMPI v4.1.1
OS	Amazon Linux 2

Table 1: Amazon EC2 Hpc6a test environment

## AMAZON EC2 HPC6A INSTANCES AND SPECIFICATIONS

SIZE	CPU CORES	MEMORY (GB)	MEMORY PER CORE (GB)	L3 CACHE (MB)	ELASTIC FABRIC ADAPTER NETWORKING
Hpc6a.48xlarge	96	384	4	384	100 Gbps

Table 2: Amazon EC2 Hpc6a instance specifications

## CONCLUSION

Amazon EC2 Hpc6a.48xlarge instances powered by AMD EPYC 7003 Series Processors offer excellent performance and scalability for running HPC workloads. The test results shown above showcase linear Simcenter STAR-CCM+ performance uplifts as the number of instances scale from 1 to 16. Amazon EC2 Hpc6a instances introduce several targeted features to deliver cost and performance optimizations for customers running tightly coupled HPC workloads that rely on high levels of inter-instance communications. With 100 Gbps Elastic Fabric Adapter networking, and AWS Nitro System making all 96 cores available, the Amazon EC2 Hpc6a instances let you scale workloads such as computational fluid dynamics, weather forecasting, and molecular dynamics, at the best price performance in Amazon EC2.<sup>3</sup>

## REFERENCES

1. 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
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 <https://aws.amazon.com/ec2/instance-types/hpc6/> for more details about Amazon EC2 Hpc6a instances.
4. Please see <https://www.plm.automation.siemens.com/global/en/products/simcenter/STAR-CCM.html> for detailed information about Simcenter STAR-CCM+.
5. Based on SPECrate®2017\_fp\_base on 07/06/2021, a server powered by two 8c AMD EPYC 72F3 CPU has scored 247, <http://spec.org/cpu2017/results/res2021q3/cpu2017-20210621-27506.html> with a per core score of 15.4 which is a higher per core floating point base performance score than any currently posted in any SPEC.org publication. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org) for more information. MLN-058B

## ACKNOWLEDGEMENTS

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### RELATED LINKS

- [Amazon EC2 Hpc6a Instances\\*](#)
- [Elastic Fabric Adapter\\*](#)
- [Amazon FSx for Lustre\\*](#)
- [AWS ParallelCluster\\*](#)
- [AWS Nitro System\\*](#)
- [AMD EPYC™ Processors](#)
- [AMD EPYC Technical Briefs and Tuning Guides](#)

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