The semiconductor business is extremely competitive. The timely introduction of the latest technology generation is essential to meeting product time-to-market goals. This is no truer than in the graphics processor industry, where a couple key vendors vie to provide the latest must-have hardware.

AMD’s Radeon Technologies Group launched its Radeon™ VII in January at the CES 2019 Las Vegas event, taking the lead as the first mainstream graphics-chip architecture to be produced on a 7nm fabrication process.

FASTER DESIGN WORK MEANS FASTER TIME TO MARKET

A key factor in AMD’s lead with its 7nm GPU chips has come from streamlined Electronic Design Automation (EDA). This is the highly iterative, multistage process of validation and testing that feeds back into the design until a new chip is ready to go into production. New circuitry must be put through its paces ‘virtually’ using simulations that look for and model optimization opportunities. These improvements go through this iterative process again to see how they perform and to look for additional opportunities for design improvements.

The analog parts of the circuit design are tested with one set of applications, such as Synopsys® FineSim® and Cadence® Spectre® Circuit Simulator. Another piece of software is used to verify that the chip microcode works, primarily Synopsys® VCS®. Then still further applications translate this design into a physical layout, including Synopsys® Design Compiler®, alongside IC Compiler™ II placement and routing. Then the design needs to be verified for physical characteristics with Mentor® Calibre® DRC, for power dynamics with ANSYS® RedHawk, and for potential performance with Synopsys® PrimeTime®.

“You need to hit your market window so that you can have an impact and your product is well received. Time is money in this business.”

Alan Pye, CIO and CVP, AMD
“Engineering productivity and time to market are some of the biggest factors in a successful design,” says Alan Pye, CIO and CVP at AMD’s Radeon Technologies Group. “You need to hit your market window so that you can have an impact and your product is well received. Time is money in this business.”

**THE QUEST FOR EDA ITERATION SPEED**

Each stage of the process is interlinked and dependent on completing the others, so a faster performance in any stage delivers an additive benefit to the entire workflow. “Running through all the stages can take from three days to a week for a single iteration,” explains Pye. “But if you can speed up all the stages, particularly those that are most frequently used like microcode verification or performance testing, you can get a new design into production much more quickly, saving money and gaining a time-to-market advantage over competitors.”

Looking for further improvements, AMD’s Radeon Technologies Group analyzed AMD’s newest EPYC™ chip, the high-frequency 7371, to determine if it would deliver significant benefits for EDA. The high-frequency characteristics demonstrated faster execution time with the software used in EDA, illustrating great improvements in design iterations that enable rapid design development.

To illustrate this, the AMD team took real data sets from the workflow of the recently released Radeon VII 7nm design and ran them on the AMD EPYC 7371, then compared the results to the same workloads run on a typical Intel-based HPC configuration. Both CPUs were tested in dual-socket data center servers from HPE—an HPE Apollo 35 for the EPYCs, and an HPE ProLiant DL380 Gen10 for the Xeons.

The AMD EPYC 7371 is nominally a 16-core 3.1GHz processor. However, all cores can run at 3.6GHz simultaneously, and up to eight cores can run at 3.8GHz. It’s aimed at HPC applications like EDA where workloads scale only to a certain number of threads and single-core clock frequency is a key factor. For comparison, AMD selected a popular Intel processor for HPC with the same number of cores, the Intel® Xeon® Gold 6142 processor. This Intel part has a nominal frequency of 2.6GHz, can run all 16 cores at 3.3GHz, and run up to two cores at 3.7GHz (vs. the AMD 7371 with 8 cores at 3.8GHz). Intel does offer CPUs with faster all-core frequencies, but these have fewer than 16 cores so don’t directly compare. It’s also worth noting that the Intel Xeon Gold 6142 is almost twice as expensive as the AMD EPYC 7371. But for EDA, the performance differential is by far the most important and compelling element.
QUICKER ROUTES TO NEXT-GENERATION TECHNOLOGY

“Running our data sets on the 7371 processor gave us phenomenal results,” explains Philip Steinke, CAD & Physical Design at AMD’s Radeon Technologies Group. “We saw up to 25% faster performance with Synopsys FineSim, 17% with Mentor Calibre DRC, and 13% with ANSYS RedHawk, and Synopsys IC Compiler II placement. Synopsys PrimeTime, which is the second most frequently used application in our data center, saw a 9% improvement. Synopsys Design Compiler and Cadence Spectre Circuit Simulator were 7% quicker, whilst Synopsys IC Compiler II routing saw a 6% improvement.”

Although the speed bump with Synopsys VCS 2018 was only 2% this is the most frequently run software in AMD’s data center (over 50% of compute cycles), because code verification is such a key part of the design process. Even a small improvement here can add up to big productivity gains for the engineers working on the designs, since they run so many iterations before moving to the next stages.

“‘There is a very real benefit available for real design work.’

Philip Steinke, Principal Engineer of Physical Design and CAO, AMD Technology & Engineering

According to Martin Ashton, CVP Silicon Design Engineering at AMD’s Radeon Technologies Group, “The combination of the savings across all the software elements adds up to about a 12% overall time savings per iteration.¹ With some iterations taking up to a week to run, the time saving with the EPYC 7371 will make a huge impact in our test and development cycles.”

“There really are no benchmarks for these applications,” explains Ashton. “Testing how these processors will perform in our environment demonstrated a significant performance benefit on very complex new technology. There is a very real benefit available for real design work.”

“AMD’s EPYC 7371 performance is superior across the board and at a lower price point,” adds Steinke. “For companies specializing in analog design such as RAM, the Synopsys FineSim results are particularly compelling. But the potential to enhance the design flow and accelerate RTL to GDSII productivity in every type of integrated circuit work is huge, whether it’s boards, systems on a chip, or graphics processing units and CPUs.”

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EPYC™ 7371 HPC TESTING – EDA

EPYC 7371 Delivers up to 25% Better Performance than Intel Xeon Gold 6142*

| EPYC 7371 - Synopsys FineSim | Up to 25% |
| EPYC 7371 - Mentor Calibre nmDRC | Up to 17% |
| EPYC 7371 - ANSYS RedHawk | Up to 13% |
| EPYC 7371 - Synopsys IC Compiler II (Placement) | Up to 13% |
| EPYC 7371 - Synopsys PrimeTime | Up to 9% |
| EPYC 7371 - Synopsys Design Compiler | Up to 8% |
| EPYC 7371 - Cadence Spectre Circuit Simulator | Up to 7% |
| EPYC 7371 - Synopsys IC Compiler II (Routing) | Up to 6% |
| EPYC 7371 - Synopsys VCS 2018 | Up to 2% |

Intel Xeon Gold 6142

- Synopsys FineSim for transient analysis of 14nm mixed signal IP (100k transistors)
- Mentor Calibre nmDRC Physical Verification for 7nm tile from graphics design with 824M flat geometries
- ANSYS RedHawk™ for dynamic IR analysis of 7nm 1,286k instance graphics design
- Synopsys IC Compiler II for placement and ideal clock optimization (place, opt command) of 950k instance 7nm tile from graphics design
- Synopsys PrimeTime (STA - Static Timing Analysis) for Interface Logic Model description of 7nm full AI/Compute SOC, 24M leaf cells
- Synopsys Design Compiler for synthesis of 7nm 1.5 million instance graphics design
- Cadence® Spectre Circuit Simulator for 7nm analog design (3k transistors)
- Synopsys IC Compiler II for Routing of 950k instance 7nm tile from graphics design
- Synopsys VCS 2018 for verification of simple graphics engine draw and asynchronous compute dispatch

### ABOUT AMD RADEON TECHNOLOGIES GROUP

AMD’s Radeon Technologies Group is responsible for the development of new graphics architectures, the hardware and software that integrate them, and the future strategy of where AMD will invest in graphics research and development. It focuses on graphics engineering, including technical strategy, architecture, hardware and software for AMD graphics products such as the Radeon and Radeon Pro family of products. For more information visit [amd.com/radeon](http://amd.com/radeon).

### ABOUT AMD

For more than 45 years AMD has driven innovation in high-performance computing, graphics, and visualization technologies—the building blocks for gaming, immersive platforms, and the data center. Hundreds of millions of consumers, leading Fortune 500 businesses, and cutting-edge scientific research facilities around the world rely on AMD technology daily to improve how they live, work, and play. AMD employees around the world are focused on building great products that push the boundaries of what is possible. For more information about how AMD is enabling today and inspiring tomorrow, visit [amd.com/epycserver](http://amd.com/epycserver).

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1. Testing conducted by AMD Performance Labs as of 31Jan2019 on an HPE Apollo 35 with 2 x 7371 AMD EPYC processors compared to HPE ProLiant DL380 Gen10 with 2 x Intel Xeon Gold 6142 processors; on the EDA Applications below. Results may vary based on configuration, and testing data. Aggregate time: AMD: 67,514,94; Intel: 76,985,46; 76,985,46 - 65,746,94 = 88,838.52 / 76,985,46 = 11% or 11% less time.
2. The HPE Apollo 35 System with the AMD EPYC 7371 processor will be available in April 2019.