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Comparing 3D Rendering Performance

32GB scene using 18-core Intel® Core™ i9-7980XE Extreme Edition processor versus a previous-generation 4-core processor

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Executive Summary

The Intel® Core™ i9-7980XE Extreme Edition processor is Intel's highest- performance processor to date for 3D mega tasking. To showcase its extreme processing capabilities, Intel teamed with Cinema 4D* designer Marc Potocnik, CEO of German animation studio renderbaron, to develop the Cinema 4D Mountainvista Scene Workload.[1]

Tests showed significant performance increases can be gained by running the Cinema 4D Mountainvista Scene Workload on the 18-core Intel Core i9-7980XE Extreme Edition processor versus a previous-generation 4-core Intel® processor.

This white paper demonstrates how 3D designers can bring additional performance to their workstations with the Intel Core i9-7980XE Extreme Edition processor.

Background

The main challenge for 3D designers has always been to make great work, stay relevant, and stand out. But, as the pace of communication increases, customers are starting to want high-quality work faster. The challenge for 3D designers now is how to balance the delivery of the same great work with increasingly accelerated turnarounds.

The advancement of technology and the development of ever-smarter software, together with an ability to think outside the box, is fundamental in helping 3D designers rise to this new challenge. But most often the limiting factor is workstation performance.

There just may not be enough processing power to get compute-heavy tasks like 3D rendering and video transcoding done in an acceptable timeframe, and even the canniest workarounds can only advance a project so far.

With this in mind, Intel continuously seeks ways to push the boundaries of processor performance. Intel is developing CPUs with accelerated speeds and increasing numbers of cores, as well as introducing new architecture improvements, such as Intel® Advanced Vector Extensions 2 (Intel® AVX2) and Intel® Advanced Vector Extensions 512 (Intel® AVX512).

Designed specifically with extreme 3D mega tasking in mind, the Intel Core i9-7980XE Extreme Edition processor is Intel's latest and highest-performance processor to date for advanced gaming, Virtual Reality (VR) and rich visual content creation.

[1] https://vimeo.com/284331194

Solution Overview

The Intel Core i9-7980XE Extreme Edition Processor

The Intel Core i9-7980XE Extreme Edition processor is designed to scale to meet the performance needs of 3D graphics designers by using its two fastest cores at higher frequencies and up to 18 cores for the most demanding tasks. It provides unprecedented performance for single socket desktops, allowing designers to simultaneously carry out multiple CPU-intensive tasks, such as 3D rendering and video transcoding, without compromising compute performance.

To improve performance of extreme tasks even further, the Intel Core i9-7980XE Extreme Edition processor is unlocked to provide additional headroom, enabling designers to overclock each core individually. The processor also supports Intel® Optane™ memory – a revolutionary new class of non-volatile memory that sits between system memory and storage to accelerate system performance and responsiveness.

The Cinema 4D Mountainvista Scene Workload

To enable 3D designers to understand the performance of their systems against the performance of the Intel Core i9-7980XE Extreme Edition processor, Intel teamed with Marc Potocnik, CEO of German animation studio renderbaron, to build the Cinema 4D Mountainvista Scene Workload.

Intel chose to work with Marc on the Cinema 4D workload due to his deep technical understanding of 3D, as well as his specialisms in shading, lighting and rendering, and working on extremely detailed scenes without using any tricks or convenience functions.

Developed by MAXON Computer GmbH in Germany, Cinema 4D is a common 3D modeling, animation, motion graphics, and rendering application used by 3D designers. It is capable of procedural and polygonal/ subdivision modeling, animating, lighting, texturing, rendering, and common features found in 3D modelling applications. Highly intuitive and accessible, Cinema 4D takes away a lot of the technical headaches, giving 3D designers the freedom to let their creativity flourish.

MAXON and Intel have a long history of collaboration. MAXON has early access to Intel® technology allowing it to optimize Cinema 4D code to run on the latest processors and software ahead of their release. MAXON also provides Intel with feedback on the development of its compilers, libraries,

and open source projects like Embree – a collection of high-performance ray tracing kernels developed at Intel. This ensures Intel® software meets MAXON's software production needs in terms of speed and stability, among others.

Workstation Specifications

To assist with the workload development, Intel gave Marc a workstation with the following specifications:

- CPU: Intel Core i9-7980XE Extreme Edition Processor with 18 cores and 36 threads, 24.75 MB Cache, and up to 4.20 GHz frequency
- Storage/ memory: Intel® Optane™ Solid State Drive (SSD) 900P up to 480GB

In addition to the workstation, Intel provided Marc with ongoing support through the development of the workload and answered technical questions when needed.

Workload Specifications

To fully test the performance of the Intel Core i9-7980XE Extreme Edition processor, Intel asked Marc to create a test scene with the following specifications:

- Memory footprint: Greater than 32 GB
- Scene size: Up to 500 MB
- Rendering time: Up to 10-15 minutes per full HD frame
- Scene: Contain high poly geometry, lots of objects, diffuse reflections, transparency, area shadows, and ambient occlusion
- Scene settings: No physically-based rendering (PBR)

It took Marc around 80 working hours to develop the Cinema 4D Mountainvista Scene Workload. Marc used onboard shading tools in the Cinema 4D R19 software to create the realistic pebbles, cliffs and landscapes that make up the mountain scene.

The Results

Intel benchmarked the performance of the Intel Core i9-7980XE Extreme Edition processor with 18 cores against the performance of a 4-core processor to render in Cinema 4D R19 using the Mountainvista Scene Workload.

We found that the Intel Core i9-7980XE Extreme Edition processor was able to reduce the render time from 19 minutes to just six minutes – see figure 1[2].

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[2] Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit www.intel.com/benchmarks.

Performance results are based on testing as of 05.22.18 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

Configurations: Intel® Core™ i7 7700K processor with 4 cores, 91W TDP, Turbo up to 4.2Ghz; Graphics: Intel® HD Graphics 630 v23.20.16.4973; Memory: 32GB; Storage: Intel® SSD 256GB M.2 and 2TB HDD; OS: Microsoft Windows* 10; BIOS build: American Megatrend Inc. P1.20, 5/12/2016 versus Intel® Core™ i9 7980XE Extreme Edition processor unlocked with 18 cores, 165W TDP, Turbo up to 4.2Ghz; Graphics: NVidia GeForce GTX 1080 Ti 23.21.13.8795; Memory: 32GB; Storage: Intel® SSD 1TB M.2; OS: Microsoft Windows* 10 Home, version 1803; BIOS Build: Alienware 1.1.10. Testing carried out by Intel on 05.22.18.

Commenting on the results Andres Hildebrandt, Vice-Director Marketing at MAXON, said: "The Intel Core i9-7980XE Extreme Edition processor offers the benefits of high core counts with high turbo speeds previously only seen in lower core count desktop CPUs. Therefore, when needed, it gives 3D artists maximum speed in inherently single-threaded tasks like simulations and impressive computing power on parallel tasks like rendering. It offers more PCI lanes than standard Intel desktop CPUs." Mr Hildebrandt believes that this allows the optimal usage of multiple GPUs or high bandwidth I/O solutions."
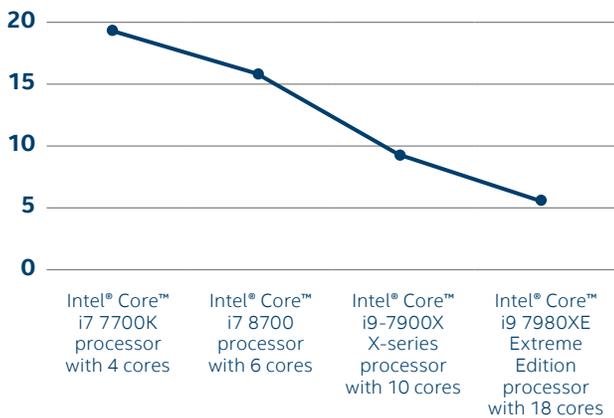
Figure 1. Time in minutes to render in Cinema 4D* R19 using the Mountainvista workload. Measured by Marc Potocnik & Intel.

Although instrumental, the number of cores wasn't the only feature of the Intel Core i9-7980XE Extreme Edition processor driving this performance improvement. The following features also played an important part:

- Intel AVX2: A feature of the Intel® Core™ processor family, Intel AVX2 expands integer commands to 256 bits and introduces fused multiply-accumulate (FMA) operations to deliver improved performance on media and floating-point compositions.

- Embree: A collection of ray-tracing kernels developed at Intel and optimized for the latest Intel® processors with support for SSE, AVX, AVX2, and AVX-512 instructions, Embree allows graphics engineers to improve the performance of photo-realistic rendering – for example, the rendering of scenes with lots of reflection and transparency like those in the Cinema 4D Mountainvista Scene Workload.

During the development of the workload Marc found that the accelerated clock speed of the Intel Core i9-7980X Extreme Edition processor effectively improved preparation for rendering, while the Intel Optane SSD helped optimize loading of heavy 3D scenes.

Conclusion

Using Cinema 4D in combination with the Intel Core i9-7980XE Extreme Edition processor allows 3D designers to optimize content delivery. It results in improvements in creativity and quality content production, and it allows artists to meet their tightest deadlines in a heavy production pipeline.

Learn More

You may find the following resources useful:

Intel® Core™ i9-7980XE Extreme Edition Processor:
www.intel.com/content/www/us/en/products/processors/core/x-series.html

Intel® Optane™ Technology:
www.intel.com/optane

Intel Rendering Software:
https://software.intel.com/en-us/modern-code/tools/software-defined-visualization

Cinema 4D* Software:
www.maxon.net/en/products/cinema-4d/overview/

Marc Potocnik, renderbaron:
www.renderbaron.de

Intel Mountainvista project:
https://vimeo.com/276057892

The 3D-animation is based on the Intel Mountainvista project. This animation makes use of brand new Cinema 4D R20 features such as multi instances, fields and node-based materials. The scene contains 139,000 trees at 600,000 polygons, and many plants and stones resulting in over 90 billion polygons. It is done with Cinema 4D R20 onboard tools only, and rendered with standard and physical render.

https://vimeo.com/284331194

Solution Provided By: