

A WINNING COMBINATION FOR 3D RENDERING: AUTODESK, INTEL, AND HP

Animators and modelers who render in Arnold locally on multi-core Intel® processors can wait less and create more.

What do all five 2017 Academy Award® nominees for Best Visual Effects have in common? Their visual effects were created using Autodesk® Maya® 3D animation software along with other Autodesk solutions, including the Arnold renderer and Autodesk® 3ds Max®.¹ Members of the Arnold research and development (R&D) team also won the Academy of Motion Picture Arts and Sciences 2016 Technical Achievement Award.² The award honors solutions that “demonstrate a proven record of contributing significant value to the process of making motion pictures.”

Arnold offers a highly optimized geometry engine and novel ray-tracing algorithms that unify the rendering of curves, surfaces, volumetrics, and subsurface scattering. These capabilities are why the Arnold renderer is now the integrated default renderer in both Autodesk Maya software and Autodesk 3ds Max software.^{3,4,5}

Maya and 3ds Max offer modeling, animation, materials, lighting, FX, and more. Maya software is one of the leading choices for 3D animation and visual-effects artists in the media and entertainment industry. 3ds Max software is one of the go-to choices for modeling and visualization of materials and buildings for architectural and engineering artists. 3ds Max also offers a more entry-level introduction to animation that can be useful for animation students.

Maya and 3ds Max require multi-core processors, and rendering requires strong processing power. To assess the difference in performance when rendering with Arnold in Maya and 3ds Max, Prowess Consulting ran a sample rendering workload on systems with Intel® processors with different numbers of cores.

We expected to see Arnold render large projects faster and more efficiently when run on Intel processors with multiple cores—locally, or in the cloud—and we did. We used Intel processors because they enable running Arnold without adding a GPU card to servers or users’ computers, which can help keep costs down. And with today’s moviegoers, gamers, and educators demanding more every year, the ability to render faster and in real-time can be crucial. If you rely on Autodesk solutions for rendering, maximize your time to create and wait less with HP® workstations powered by Intel processors.



149.75%

faster to render in Autodesk® Maya® 2018 using the Intel® Xeon® Platinum 8180 processor compared to the Intel Xeon processor W-2195⁷



87.78%

faster to render in Autodesk® 3ds Max® 2018 using the Intel® Core™ i9-7900X X-series processor compared to the Intel Core i7-8700 processor extreme edition⁷

Arnold: The Clear Choice for Artists: From Freelancers to Top Studios

Arnold was co-developed with Sony Pictures Imageworks, and it remains the visual effects and character-animation studio's renderer of choice. It is also the renderer of choice for more than 300 studios worldwide, in addition to many professional and student computer animators and modelers.⁶ The advanced Arnold Monte Carlo ray tracing renderer is built for the demands of feature-length animation and visual effects. It is also easy to use, enabling artists and developers alike to use Arnold to quickly render amazing effects.

Solid Angle, the original maker of Arnold, joined Autodesk in 2016. All versions of Maya 2017 and 3ds Max 2018 and newer include Arnold as the integrated default renderer, which has introduced Arnold and high-end rendering to students, hobbyists, and freelancers.



Autodesk® Maya®

Studios and visual effects artists depend on Maya for their animation, visual effects, simulation, and rendering needs. Maya is widely used by the entertainment industry to produce movies and games. It enables visual effects artists to produce animations, motion graphics, virtual reality (VR), and realistic characters.

Arnold RenderView, which is integrated into Maya, lets artists view changes in real-time, including lighting, materials, and camera changes. Maya is compatible with systems running Windows®, macOS®, or Linux®.



Autodesk® 3ds Max®

3ds Max is a modeling, animation, and rendering software. Its ability to create worlds for games, scenes for design visualization, and VR experiences makes it a favorite for architectural and engineering uses. The Arnold for 3ds Max (MAXtoA) plug-in integrated into 3ds Max enables access to Arnold's latest features. 3ds Max is compatible with systems running Windows.



Technicolor Uses a Virtual-Reality (VR) Plug-in in Arnold with Intel® Xeon® Scalable Processors

Professional workstations are a key component in the creation of 3D VR media content. And companies like Technicolor are using Intel Xeon Scalable processors to push the boundaries of immersive media by accelerating the creation, rendering, and processing of this data, and bringing the ultimate VR experience to life.

See the [Groundbreaking Experiences in VR video](#) for more information.

Test Scenario: Autodesk Maya

We simulated a scenario where a media and entertainment studio is using Maya and Intel® Xeon® processors as part of an on-premises or hybrid-cloud installation—smaller projects might be rendered in a public or hybrid cloud and larger projects might be rendered on a local workstation. Even though we chose Maya, users are likely to see comparable performance gains when running 3ds Max with other renderers on local Intel Xeon processors.

Test Scenario: Autodesk 3ds Max

We chose 3ds Max and Intel® Core™ processors for a simulation where an artist is running 3ds Max on an individual system. Even though we chose 3ds Max, users should see comparable performance gains when using Maya with other renderers locally on workstations powered by Intel Core processors.

Test Scenario: Arnold Renderer

We simulated a scenario where a media and entertainment studio or an individual artist is using the Arnold 5 renderer alone to render the scene of a room. We ran this scenario on both Intel Xeon processors and Intel Core processors.

All Intel processors chosen for testing support Intel SSE4.1 or higher.

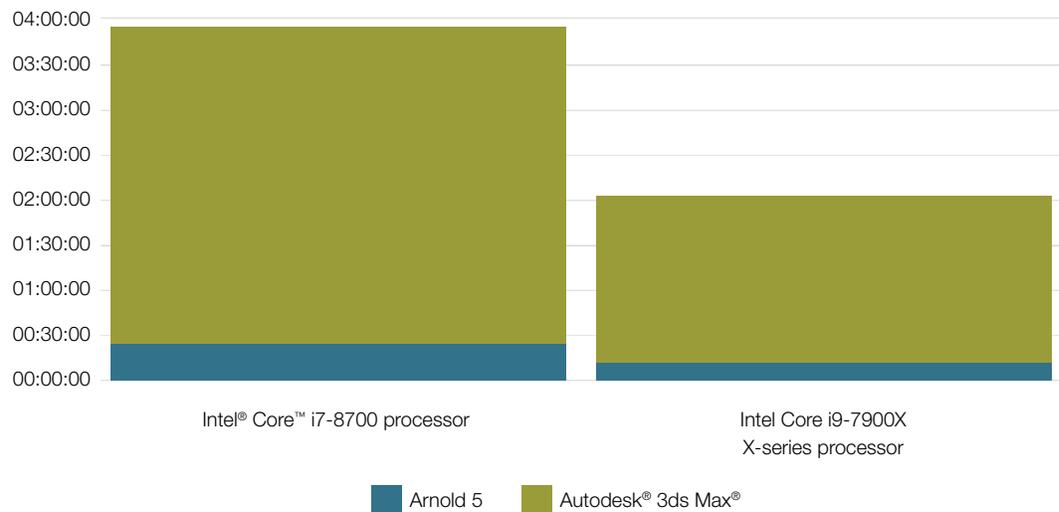


Figure 1. Rendering times in hours, minutes, and seconds, shown by the workload and devices tested; results show that Autodesk® Maya® takes advantage of cores even more than Arnold 5 used as a stand-alone renderer

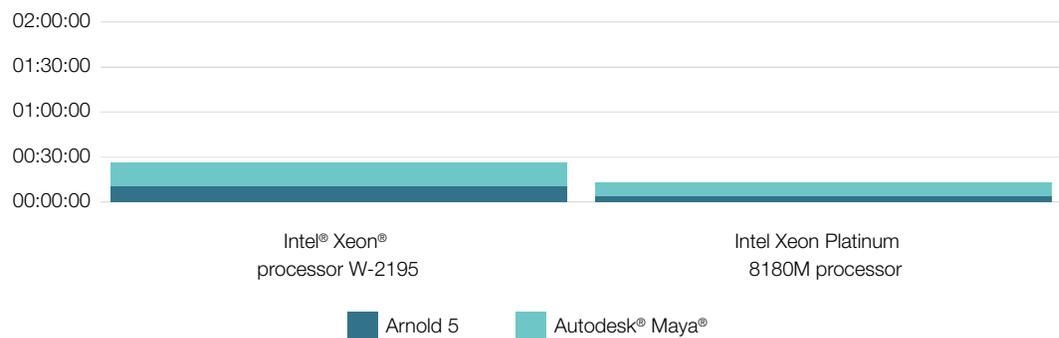


Figure 2. Rendering times in hours, minutes, and seconds, shown by the workload and devices tested; results show that Autodesk® 3ds Max® takes advantage of cores even more than Arnold 5 used as a stand-alone renderer

And the Winner Is ...

What we saw in our testing is that Arnold renders large projects fastest and most efficiently when the projects are run on latest-generation Intel processors with more cores, more threads, and new technology enhancements.

Table 3. Rendering times in hours, minutes, and seconds show that Autodesk® Maya® benefits from additional cores even more than Arnold 5 does when it is used as a standalone renderer⁷

| Rendering Times with Intel® Xeon® Processors | | |
|--|---|-------------------------------------|
| Software | Autodesk® Maya® 2018 with Arnold 5 renderer | |
| Workstation | HP® Z4 G4 Workstation | HP Z8 G4 Workstation |
| Processors | Intel Xeon processor W-2195 | Intel Xeon Platinum 8180M processor |
| Rendering Time | 00:27:40 | 00:11:05 |
| Percent Faster for More Cores | 149.75% | |
| Software | Arnold 5 renderer | |
| Rendering Time | 00:10:09 | 00:03:38 |
| Percent Faster for More Cores | 179.02% | |

Table 4. Rendering times in hours, minutes, and seconds show that Autodesk® 3ds Max® benefits from additional cores even more than Arnold 5 does when it is used as a standalone renderer⁷

| Rendering Times with Intel® Core™ Processors | | |
|--|--|--|
| Software | Autodesk® 3ds Max® 2018 with Arnold 5 renderer | |
| Workstation | HP® OMEN® 880-P1XX | HP OMEN X 900-2XX |
| Processors | Intel Core i7-8700 processor | Intel Core i9-7900X X-series processor |
| Rendering Time | 03:49:56 | 02:02:27 |
| Percent Faster for More Cores | 87.78% | |
| Software | Arnold 5 renderer | |
| Rendering Time | 00:26:02 | 00:13:20 |
| Percent Faster for More Cores | 95.13% | |

Why Intel Processors with More Cores?

A workstation running on a multi-core processor can be a powerful productivity tool that enables accelerated creation and innovation.

Intel Xeon Scalable processors deliver dual-socket performance for professionals who need the most advanced workstations.¹⁰ With more high-quality Intel cores, professionals can enjoy increased performance and scalability for compute-intensive workloads. And integrated Intel technologies can help further boost performance:

- **Error correcting code (ECC)** automatically detects and repairs single-bit errors on the fly to keep workstation apps running quickly and corruption-free.
- **Intel® Advanced Vector Extensions 512 (Intel® AVX-512)** enables two times the floating-point operations per second (FLOPS) per clock cycle compared to the previous generation to increase performance for demanding computational tasks, such as modeling and simulation, visualization, and digital content creation.¹¹
- Intel AVX-512 includes optimized support for **Open Shading Language (OSL)**. OSL is a language for programmable shading in advanced renderers, and it was originally developed by Sony Pictures Imageworks for Arnold. Intel, Sony Pictures Imageworks, and Pixar Animation Studios have collaborated to improve the performance of OSL computations on latest-generation Intel hardware.
- **Six memory channels** support high performance computing (HPC) applications.
- **Intel® QuickAssist Technology (Intel® QAT)** provides hardware acceleration for data compression, which frees the host processor to focus on other critical workloads.
- **Integrated Intel® Ethernet** products provide high-bandwidth access to rendering servers when needed. And if those servers include Intel Xeon Scalable processors, users can enjoy performance gains whether those servers are on-premises, part of a hybrid cloud, or in a public cloud.
- **Integrated memory, storage, and networking dynamically self-provision resources** based on workload needs—on-premises, through the network, and in the public cloud.

“I often get questions from people in production or building out render farm infrastructures about the kind of systems needed to get the most out of rendering capacity. I tell them that for Arnold it’s about cores ahead of things like memory capacity.”

— Ben Fischler, Industry Marketing Manager, Autodesk⁸



Intel Core X-series processors offer up to 10 cores for extreme performance and mega-tasking. Having more cores enables artists—from hobbyists and students to professionals—to render 3D effects, edit a video, and compose a soundtrack simultaneously without compromising the host computer’s performance. Intel Core X-series processors also support 4K visuals and high-speed storage and memory. Each core has overclocking enabled. And integrated Intel technologies further boost performance:

- **Intel AVX-512 with Intel AVX ratio controls** provides added stability and lower core temperatures when running Intel AVX workloads, in addition to optimized support for OSL.
- **VccU voltage control** supports extreme overclocking scenarios.
- **Intel® Extreme Tuning Utility (Intel® XTU)** is a simple Windows performance tuning application for novice and experienced enthusiasts to overclock, monitor, and stress a system.

Animators Can Render Faster, Wait Less, and Create More with Newer Processors

Our simulations support that animators and modelers who want to wait less and create more will benefit from the Arnold renderer integrated into Maya or 3ds Max and run on the Intel multi-core processors.

Visit the following resources for more information:

- Arnold global illumination rendering software: www.autodesk.com/arnold
- Maya computer animation software: www.autodesk.com/maya
- 3ds Max 3D modeling, animation, and rendering software: www.autodesk.com/3dsmax
- Autodesk Media & Entertainment Collection: www.autodesk.com/collections/media-entertainment
- Intel Xeon Scalable processors: www.intel.com/xeonscalable
- Intel Core X-series processors: www.intel.com/content/www/us/en/products/processors/core/x-series.html
- Intel workstations page: www.intel.com/workstations
- Intel® Developer Zone virtual reality: <https://software.intel.com/en-us/vr/markets>
- HP VR commercial solutions: <http://www8.hp.com/us/en/solutions/vrready/index.html>

“With the introduction of Intel Xeon Scalable processors, artists can spend more time creating immersive VR experiences and less time rendering with Autodesk Arnold.”

— Tim Allen, Global Alliance Manager, Intel¹²

¹ Autodesk. "Autodesk Wins are Twofold this Awards Season." February 2017. <http://news.autodesk.com/2017-02-23-autodesk-wins-are-twofold-this-awards-season>.

² Academy of Motion Picture Arts and Sciences. "18 Scientific and Technical Achievements to Be Honored with Academy Awards." January 2017. www.oscars.org/news/18-scientific-and-technical-achievements-be-honored-academy-awards-0.

³ AWN. "Autodesk Unveils Arnold Integration for Maya 2017." July 2016. www.awn.com/news/autodesk-unveils-arnold-integration-maya-2017.

⁴ Autodesk. "3ds Max Features." www.autodesk.com/products/3ds-max/features.

⁵ Requires a license of Arnold. To purchase Arnold, go to www.autodesk.com/arnold to find a local reseller.

⁶ Solid Angle. "What Is Arnold?" www.solidangle.com/arnold/.

⁷ Comparing the results for the workstations running the specified workloads with the specified software.

Configuration Baselines: HP® Z8 G4 Workstation, two Intel® Xeon® Platinum 8180M processors (2.50 GHz, 28 cores, 56 threads) for rendering a character animation rendered in 4K using the Arnold 5 renderer in Autodesk® Maya® 2018 and rendering the scene of a room in the Arnold 5 renderer. Compared to: HP Z4 G4 Workstation, one Intel Xeon processor W-2195 (2.30 GHz, 18 cores, 36 threads) for rendering a character animation rendered in 4K using the Arnold 5 renderer in Autodesk Maya 2018 and rendering the scene of a room in the Arnold 5 renderer.

HP® OMEN® X 900-2XX, one Intel Core i9-7900X X-series processor (3.30 GHz, 10 cores, 20 threads) for rendering an Autodesk® Revit® model imported into Autodesk® 3dsMax® 2018 of a building walkthrough scene using the Arnold 5 renderer and rendering the scene of a room in the Arnold 5 renderer. Compared to: HP OMEN 880-P1XX, one Intel® Core™ i7-8700 processor (3.20 GHz, 6 cores, 12 threads) for rendering a Revit model imported into 3ds Max 2018 of a building walkthrough scene using the Arnold 5 renderer and rendering the scene of a room in the Arnold 5 renderer.

⁸ Ben Fischler, Industry Marketing Manager, Autodesk, personal communication with Prowess Consulting, Oct. 20, 2017.

⁹ Josh Peterson, Director, Worldwide Product Management, Workstations, HP, personal communication with Prowess Consulting, Dec. 19, 2017.

¹⁰ Statements are based on new Intel® products and features compared against historical Intel products and features. Unless otherwise noted, statements and examples referencing Intel® Xeon® Scalable processors are shown based on a dual-socket configuration. Statements and examples referencing Intel Xeon W processors are shown as single-socket configurations only.

¹¹ Intel. "Accelerate Your Compute-Intensive Workloads." www.intel.com/content/www/us/en/architecture-and-technology/avx-512-overview.html.

¹² Tim Allen, Global Alliance Manager, Intel, personal communication with Prowess Consulting, Feb. 9, 2018.



The analysis in this document was done by Prowess Consulting and commissioned by Intel.

Results have been simulated and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

Benchmark results were obtained prior to Intel's implementation of recent software patches and firmware updates intended to address exploits referred to as "Spectre" and "Meltdown." Implementation of these updates may make these results inapplicable to your device or system.

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