



Ray Tracing for Everyone, On-Premises or in the Cloud

Image courtesy of Digital Domain © Marvel 2018

“V-Ray* is the industry’s gold standard for ray traced rendering and Intel has been there for us from the beginning—with high-performance, multi-core processors and optimization software. We’re now delivering on-demand rendering with Chaos Cloud where Intel continues to provide the scalability that we count on.”

- Phillip Miller, VP of Product Management,
Chaos Group.

CHAOSGROUP

Executive Summary

CGI and ray tracing advances have revolutionized the creation and animation of imagery based on 3D models, leading to tremendous opportunities for filmmakers, architects, and designers. For ongoing success in this market sector, Chaos Group sought to provide reliable, flexible rendering services to a broad spectrum of businesses with different requirements, scaling easily from small projects to large-scale VFX, including *Avengers: Endgame** and HBO’s *Game of Thrones**. They also looked to expand existing rendering solutions to the cloud.

Chaos Group chose to build their on-premises and new cloud-based services utilizing the Intel® Rendering Framework as part the Intel Visual Cloud platform, taking advantage of Intel’s reliability, scalability, low total cost of ownership (TCO), and open standards.

Challenge

Chaos needed to give any customer in any industry the ability to render any ray traced content, delivering:

Reliable rendering services to architects, designers, and filmmakers.

Highest quality scenes for the most challenging work.

Scalability on demand to accommodate any size project, large or small, from small- to mid-sized businesses (SMBs) to top visual effects studios producing feature films.

Cost-effective and on-time delivery of rendered content.

Expanded ray tracing capabilities to the cloud.

Solution

Chaos Group chose Intel and the Intel Visual Cloud platform to:

Support the high compute demands of ray tracing, with dependable solutions that can accommodate massive memory resources and scale fluidly to meet the most demanding project requirements.

Deliver cost-effective performance, supporting increases in the number of cores and memory in a linear manner to boost overall performance predictably without incurring high expenses.

Operate flexibly locally or in the cloud, ensuring Chaos customers have the flexibility and choice to meet rendering needs, serving smaller businesses and individuals, as well as enterprise-scale studios.

CGI and Ray Tracing Expand the Boundaries of Creativity

Technology advances make it possible to create astonishing panoramic vistas and construct animations of anything the human mind can visualize. Ray tracing, as developed and enhanced by the Chaos Group over the last 20 years, has been at the center of this innovative revolution, enabling photorealistic architectural visualizations, mind-bending visual effects in cinema, and intricate depictions of other worlds with breathtaking detail. Applications of 3D CGI modeling have skyrocketed with the development of solutions and infrastructures that give unprecedented creative powers to everyone, from leading film studios running server farms with hundreds of computers to individuals working on projects from their remote laptops.

The infrastructures that enable the compute-intensive ray tracing breakthroughs pioneered by Chaos Group have been built on a foundation of Intel® technology and components, from latest generation Intel® Xeon® Scalable processors to the networking hardware and software that underlie the visual cloud.

The ray tracing technology that has made V-Ray* a dominant force in visual effects and architecture has now been extended to the visual cloud, taking advantage of Intel expertise in cloud computing.

Intel Helps Bring Characters and Scenes to Life

Chaos Group chose Intel from the very beginning. With a unique combination of reliability, scalability, cost-effectiveness, and speed, Intel Xeon Scalable processors provide Chaos Group and its customers with near linear ray tracing acceleration across multiple cores and CPUs, and across machines for animations. V-Ray on Intel takes advantage of current and future hardware infrastructures, including open source tools, so there's no worrying about compatibility, memory limits, or updating drivers. With the constant advances in additional compute power, more abundant cores, and expanded memory access, Chaos Group continues to build successful solutions on Intel's platform.

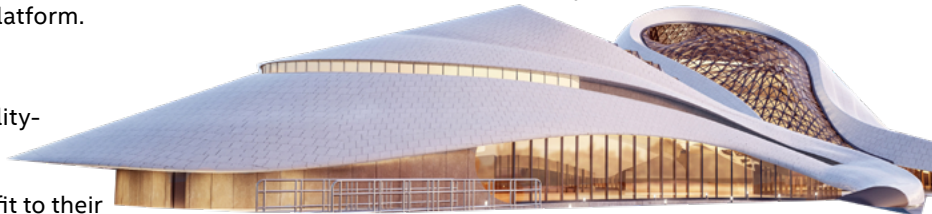


Image courtesy of TILTPIXEL

The Intel Abilities

- **Reliability:** Intel is dedicated to providing quality-tested chipsets and hardware that deliver outstanding [reliability in the field](#). Chaos Group recognizes this reliability as a key benefit to their customers and as an important part of their overall solution.
- **Predictability:** The V-Ray solutions running on an Intel® architecture based platform eliminate many customer concerns about implementing a complex ray tracing solution. In particular, the Chaos Cloud solution removes worries about sufficient memory being available, the need for dedicated GPU hardware, obtaining the correct drivers to enable the solution, and other similar issues. V-Ray and Chaos Cloud are designed to always work, simply and reliably, and the Intel® platform helps achieve this.
- **Scalability:** Scaling for high-demand workloads and the rendering of data-intensive 3D models is effectively handled by built-in hardware capabilities, particularly with the features provided by Intel Xeon Scalable processors.

Low TCO

Ray tracing lends itself well to parallel processing, but another vital requirement of an effective rendering solution is the ability to cost-effectively scale across all of your existing and processor cores. V-Ray accommodates massive levels of scaling, cutting rendering time by providing near-linear acceleration as cores and processors are made available.

The Intel Xeon Scalable platform, developed for next-generation data center modernization with increased core count, helps improve operational efficiencies, whether rendering is being performed in-house or in the cloud. This in turn can lower the total cost of ownership (TCO) for organizations implementing V-Ray locally and provides high productivity for users. Systems built on the [Intel Xeon Scalable platform reduce TCO](#) because of lower software and OS licensing fees, and acquisition, maintenance, and infrastructure costs. V-Ray's distributed rendering capability makes it possible to support CPUs wherever they may be available across the network, using under-utilized servers within the organization.



Image courtesy of A52

The New Chaos Cloud

Chaos Cloud frees artists, architects, and animators from the costs and configuration obstacles associated with on-premises rendering infrastructures.

The key advantages of Chaos Cloud include:

- **Next-generation compute power:** Customers can access the potent compute power of the latest Intel processor technology and compete effectively against larger firms.
- **Dynamic flexibility:** To accommodate demanding project requirements, customers can take advantage of fast, persistent memory scaled to the project scope; dynamic asset balancing as a project progresses; and a processor core count that meets project goals.
- **Simplicity:** The push-button approach to ray traced rendering makes it possible to begin operations as soon as the source files are ready. A “Cloud” button in V-Ray for Revit*, 3ds Max*, Maya*, and other supported applications, starts the process.
- **Easy monitoring:** Monitoring of the rendering process can be followed throughout operations, including on your mobile device.
- **Pay as you go:** Pay only for the compute resources you need when you need them.

Open-Source Benefits

V-Ray and Chaos Cloud were engineered to take advantage of the open-standards, commercial off-the-shelf systems powered by the [Intel Rendering Framework](#), which includes Embree. V-Ray support for [Embree](#), a ray tracing accelerator that Intel originally helped develop and then released to the open-source community, improves the performance of ray casting operations. Support for Embree can significantly accelerate 3D displacements and subdivision surfaces. Embree libraries can also be used for motion blur, hair modeling, and other ray casting tasks.

The collection of ray tracing kernels composing Embree have been optimized for the features of the latest Intel® processors. Support for Intel® Streaming SIMD Extensions (Intel® SSE), Intel® Advanced Vector Extensions (Intel® AVX), Intel® Advanced Vector Extensions 2 (Intel® AVX2), and Intel® Advanced Vector Extensions 512 (Intel® AVX-512) can boost performance for those applications that have been tailored to use these capabilities, including Chaos V-Ray.

Network Rendering Methods

To leverage the compute power across the entire internal network, V-Ray can use distributed rendering with many machines working on a large image at the same time or animation rendering with each machine rendering a frame at a time.

V-Ray has been designed to employ the unique characteristics of Intel®-based processor technology, harnessing available CPUs throughout the entire network and flexibly applying resources to meet the unique requirements of different projects. Two types of network rendering are supported: *headless* rendering, in which the render farm is managed as if each host is a copy of the workstation running V-Ray and standalone rendering, in which the renderer has full access to all system resources.

This same flexibility has been deployed in Chaos Cloud, but the configuration adjustments are handled automatically and the resulting rendered content is returned efficiently and cost effectively.

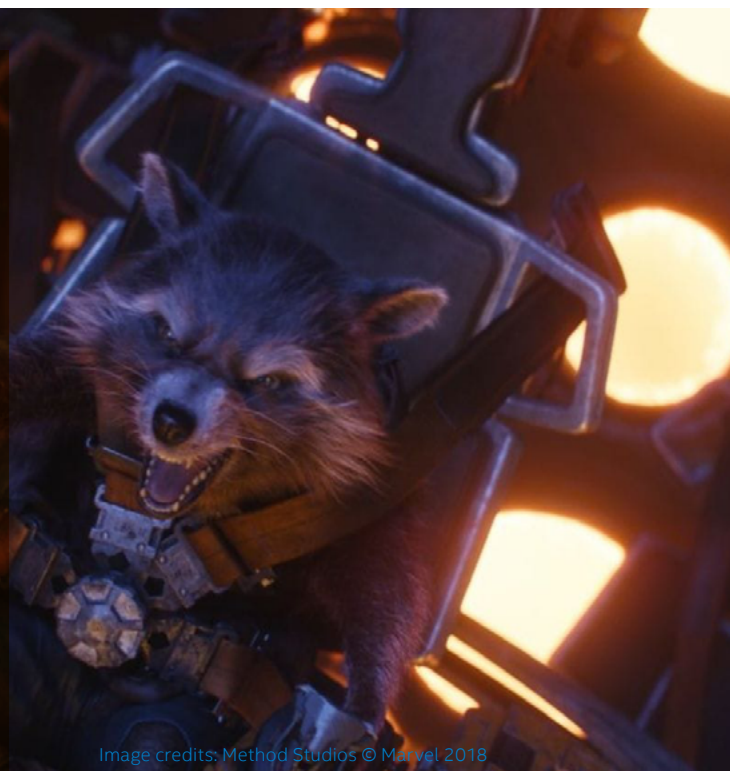


Image credits: Method Studios © Marvel 2018

Figure 1. Rocket Raccoon rendered by V-Ray.

Operate Locally or in the Cloud

The choice of rendering solutions for ray tracing operations depends on several different factors. With V-Ray and Chaos Cloud, Chaos can support the needs of small studios and individuals all the way up through the largest moviemaking and architectural design enterprises. To those firms that want to maintain tighter control over computing operations and use in-house resources, V-Ray is well-suited to those requirements. For companies that want to tap into only the computing power required to accomplish the rendering of a project, the new Chaos Cloud is available on demand, offering supercomputing performance when it is needed without the expense of purchasing or maintaining high-end machines.

“Chaos Cloud will be there whenever you need it, as a natural extension to your workflow. As needs arise, just submit a job and we’ll do the rest. It’s really simple.”

- Boris Simandoff, Chaos Cloud Director of Engineering,
Chaos Group

Real-World Examples



Image courtesy of Digital Domain © Marvel 2018

Figure 2. Meticulous detail in the animation rendering of Thanos made the character come alive.

The Animation of Thanos

- **Digital Domain, creators of Thanos from *Avengers: Infinity War* and *Avengers: Endgame*, chose Chaos V-Ray for their rendering workloads.**
- **The complex character presentation required the development of new techniques and the scope of the project tested the outer boundaries of the tools used.**
- **The Digital Domain team rendered in V-Ray on an Intel architecture-based platform for all their work**

The animation and rendering work accomplished in the film *Avengers: Infinity War* brings the arch villain of the film, Thanos, to life. The complex character presentation for this performance required the development of new techniques and the scope of the project tested the outer boundaries of the tools used. Thanos appeared in scenes that ran for more than 40 minutes of the film.

The face pipeline, developed by Digital Domain to ensure a subtle performance precisely capturing in detail the expressions conveyed by the Thanos actor, Josh Brolin, involved modeling that including the smallest facial characteristics. The rendering of individual pores, beard stubble, skin wrinkles, and skin color under different conditions added another dimension of reality to the Thanos character. Over a period of more than two years, Digital Domain worked on approximately 500 shots employing 350 people in the production. For the full story, visit the Chaos Group site and read [“Digital Domain on Thanos: The Devil is in the Detail.”](#)

Fernando Brandao—Lead Lighting/LookDev Artist at Digital Domain—noted, “We were worried about adding peach fuzz to the asset, but once we did we noticed that the render was not increasing that much. V-Ray handled the challenge like a champion without a significant impact on render time and noise.” The Digital Domain team rendered in V-Ray on an Intel architecture-based platform for all their work.



Figure 3. Harbor Opera House rendered by Chaos Cloud and Intel.

Architectural Visualization in the Cloud

- **TILTPIXEL, an architectural visualization company, tried out the new Chaos Cloud.**
- **Chaos Cloud was almost seamless with their current workflow and didn't require them to create a new account.**
- **Rendering time for sequences were faster than on-premises trials: three and a half hours locally on 20 machines versus two hours in the cloud using 10 machines.**

Chaos Cloud has definite appeal to studios and individuals who are working on projects that require more compute performance than is available in-house. Houston-based TILTPIXEL, recognized for their expertise in producing high-quality architectural renderings, maintains a dedicated render farm internally and provides custom-designed workstations for artists, but decided to try out the capabilities of Chaos Cloud for a new project: creating an animated architectural visualization of the Harbin Opera House.

From the perspective of TILTPIXEL, workflow efficiency is always a premium consideration. The fact that Chaos Cloud access is built into the V-Ray application minimizes the steps needed to perform rendering.

Ramy Hanna, a partner at TILTPIXEL, found rendering through the cloud service a smooth, trouble-free experience. "While in the past we have not leaned toward cloud services, the process for this one is almost seamless with our current workflow and doesn't require us to create a new account somewhere else."

Actual rendering time for sequences was quicker than the on-premises trials. "One of our sequences," Ramy said, "which took three and a half hours on our farm of 20 machines, took two hours on the cloud using 10 machines. It's definitely newer technology and faster when comparing pure rendering time. There is a translation time for uploading the scene, but V-Ray is very smart about how it handles this—it uses .vrscene files and only uploads portions of it that are new to the scene."² For the full story, visit the Chaos Group site and read "[How Easy Is It to Render on the Chaos Cloud?](#)"

The Visual Cloud by Intel

With visual computing services growing at an accelerating pace, cloud service providers (CSPs), communications service providers (CoSPs), and enterprises are rethinking the physical and virtual distribution of compute resources to more effectively balance cost and deployment efficiency while achieving exceptional performance. Contending with the onslaught of new visual workloads will require more nimble, scalable, virtualized infrastructures; the capability of shifting workloads to the network edge when appropriate; and a collection of tools, software, and hardware components to support individual use cases.

Visual cloud computing consists of a set of capabilities for remotely consuming content and services that center around efficient delivery of visual experiences from the cloud—both live and file-based. Additionally, visual cloud includes media analytics applications that add intelligence to video content. As shown in the figure below, the visual cloud has five major services.

For more information, visit www.intel.com/visualcloud.

Visual Cloud Services

All require high performance, high scalability, and full hardware virtualization

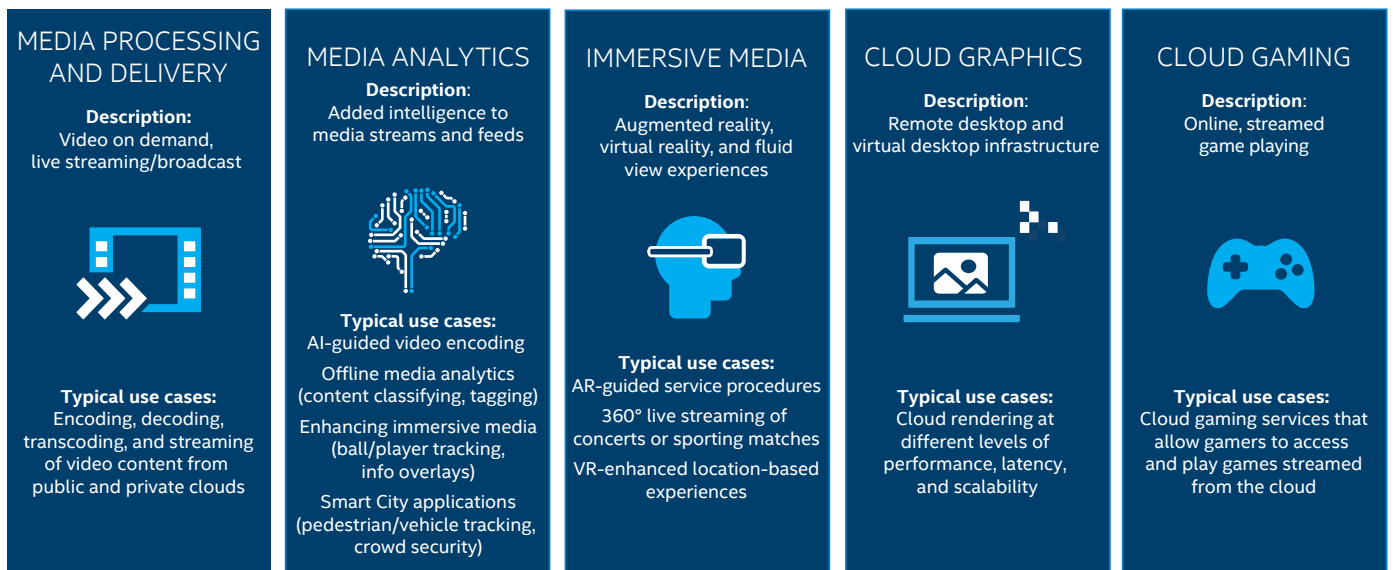


Figure 4. Visual cloud services based on Intel® technology encompass different visual experiences.



Figure 5. Architectural design rendered in V-Ray using Intel Xeon Scalable processors.

Image credits: © Uniform

About Chaos Group

Chaos Group is a worldwide leader in computer graphics technology, helping artists and designers create photorealistic imagery and animation for architecture, design, and visual effects. Chaos Group's award-winning, physically based rendering and simulation software is used daily by top design studios, architectural firms, advertising agencies, and visual effects companies around the globe. Today, the company's research and development in cloud rendering, material scanning, and virtual reality is shaping the future of creative storytelling and digital design. Founded in 1997, Chaos Group is privately owned with offices in Sofia, Prague, Los Angeles, Seoul, and Tokyo. For more information, visit [chaosgroup.com](https://www.chaosgroup.com).



¹ Clee, Lynette. *Digital Domain on Thanos: The Devil is in the Detail*. Chaos Group. December 2018. <https://www.chaosgroup.com/blog/digital-domain-on-thanos-the-devil-is-in-the-detail>.

² Winchester, Henry. *How Easy Is It to Render on the Chaos Cloud?* Chaos Group. September 2018. <https://www.chaosgroup.com/blog/how-easy-is-it-to-render-on-the-v-ray-cloud-tiltpixel-puts-it-to-the-test>.

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