Unreal Engine

Unreal Engine is a game engine developed by Epic Games, first showcased in the 1998 first-person shooter game *Unreal*. Initially developed for PC first-person shooters, it has since been used in a variety of genres of three-dimensional (3D) games and has seen adoption by other industries, most notably the film and television industry. Written in C++, the Unreal Engine features a high degree of portability, supporting a wide range of desktop, mobile, console and virtual reality platforms.

The latest generation is Unreal Engine 4, which was launched in 2014 under a subscription model. Since 2015, it can be downloaded for free, with its source code available on a GitHub private repository. Epic allows for its use in commercial products based on a royalty model, typically asking developers for 5% of revenues from sales, though with the success of *Fortnite*, which has become a testbed for Unreal Engine for Epic, Epic waives this fee for developers that publish their games through the Epic Games Store. On May 13, 2020, Epic announced that their portion of royalties for games developed in Unreal Engine are waived until developers have earned their first US$1 million in revenue, retroactively applying to January 1, 2020. Unreal Engine 5 is scheduled for full release in early 2022.

It is popular among PC and console games with high graphics capabilities and is used for numerous games, as well as finding further use in filmmaking and other business applications.

Unreal Engine	
Screenshot of Unreal Engine 4.20	
Original author(s)	Tim Sweeney
Developer(s)	Epic Games
Stable release	4.26.1[1] 🖉 (2 February 2021) [±] (https://en.wikipedia.org/w/index.php?title=Template:Latest_stable_software_release/Unreal_Engine&action=edit)
Written in	C++
Size	11.2GB
License	Source-available commercial software with royalty model for commercial use[2]
Website	unrealengine.com (http://www.unrealengine.com)
🌐 List of games	

Contents

History

First generation

A screenshot of the first version of UnrealEd, displaying a graphical user interface written in Visual Basic[3]

The first-generation Unreal Engine was developed by Tim Sweeney, the founder of Epic Games.[4] Having created editing tools for the shareware games *ZZT* (1991) and *Jill of the Jungle* (1992),[5] Sweeney began writing the engine in 1995 for the production of a game that would later become a first-person shooter known as *Unreal*.[6][7][8] After years in development, it debuted with the game's release in 1998,[9] although MicroProse and Legend Entertainment had access to the technology much earlier, licensing it in 1996.[3] According to an interview, Sweeney wrote 90 percent of the code in the engine, including the graphics, tools, and networking.[10]

At first, the engine relied completely on software rendering, meaning the graphics calculations were handled by the CPU.[4] However, over time, it was able to take advantage of the capabilities provided by graphics cards, focusing on the Glide API, specially designed for 3dfx accelerators.[11][12] While supported, OpenGL and Direct3D reported a slower performance compared to Glide due to their deficiency in texture management at the time.[13][14] Sweeney heavily criticized OpenGL drivers in particular, describing them as "extremely problematic, buggy, and untested", and labeled the code in the implementation as "scary" as opposed to the simpler and cleaner support for Direct3D.[13] With regard to audio, Epic employed the Galaxy Sound System, a software programmed in assembly language that integrated both EAX and Aureal technologies, and allowed the use of tracker music, which gave level designers flexibility in how the soundtrack was played at a specific point.[15][16][17] Sweeney stated that the hardest part of the engine to program was the renderer, as he had to rewrite it several times during development, though he found less "glamorous" the infrastructure connecting all the subsystems.[18] Despite requiring a significant personal effort, he said the engine was his favorite project at Epic, adding: "Writing the first Unreal Engine was a 3.5-year, breadth-first tour of hundreds of unique topics in software and was incredibly enlightening."[19]

Among its features were collision detection, colored lighting, and a limited form of texture filtering.[12] The engine also integrated a level editor, UnrealEd,[20] that had support for real-time constructive solid geometry operations as early as 1996, allowing mappers to change the level layout on the fly.[21][11] Even though *Unreal* was designed to compete with id Software (developer of *Doom* and *Quake*), co-founder

John Carmack complimented the game for the use of 16-bit color and remarked its implementation of visual effects such as volumetric fog. "I doubt any important game will be designed with 8-bit color in mind from now on. Unreal has done an important thing in pushing toward direct color, and this gives the artists a lot more freedom," he said in an article written by Geoff Keighley for *GameSpot*.[8] "Light blooms [the spheres of light], fog volumes, and composite skies were steps I was planning on taking, but Epic got there first with Unreal," he said, adding: "The Unreal engine has raised the bar on what action gamers expect from future products. The visual effects first seen in the game will become expected from future games."[8]

Unreal was noted for its graphical innovations, but Sweeney recognized in a 1999 interview with *Eurogamer* that many aspects of the game were unpolished, citing complaints about its high system requirements and online gameplay issues.[23] Epic addressed these points during the development of *Unreal Tournament* by incorporating several enhancements in the engine intended to optimize performance on low-end machines and improve the networking code, while also refining the artificial intelligence for bots to display coordination in team-based environments.[24] The game also came with increased image quality with the support for the S3TC compression algorithm, allowing for 24-bit high resolution textures without compromising performance.[25] In addition to being available on Microsoft Windows, Linux, Mac and Unix,[26] the engine was ported through *Unreal Tournament* to the PlayStation 2 and, with the help of Secret Level, to the Dreamcast.[27][28]

Harry Potter and the Sorcerer's Stone for PC was developed with the *Unreal Tournament* version of the engine using assets from the 2001 film[22]

By late 1999, *The New York Times* indicated that there had been sixteen external projects using Epic's technology, including *Deus Ex*, *The Wheel of Time*, and *Duke Nukem Forever*,[26] the latter of which was originally based on the *Quake II* engine.[29] Unlike id Software, whose engine business only offered the source code, Epic provided support for licensees and met with them to discuss improvements to its game development system.[3][30] While it cost around $3 million to produce and licenses for up to $350,000,[26] Epic gave players the ability to modify its games with the incorporation of UnrealEd and a scripting language called UnrealScript, sparking a community of enthusiasts around a game engine built to be extensible over multiple generations of games.[31][32][33][34]

> The big goal with the Unreal technology all long was to build up a base of code that could be extended and improved through many generations of games. Meeting that goal required keeping the technology quite general-purpose, writing clean code, and designing the engine to be very extensible. The early plans to design an extensible multi-generational engine happened to give us a great advantage in licensing the technology as it reached completion. After we did a couple of licensing deals, we realised it was a legitimate business. Since then, it has become a major component of our strategy.
>
> — Sweeney, *Maximum PC*, 1998[34]

Unreal Engine 2

In October 1998, IGN reported, based on an interview with affiliate *Voodoo Extreme*, that Sweeney was doing research for his next-generation engine.[35] With development starting a year later,[26] the second version made its debut in 2002 with *America's Army*, a free multiplayer shooter developed by the U.S.

Killing Floor was built in Unreal Engine 2

Army as a recruitment device.[36][37] Soon after, Epic would release *Unreal Championship* on the Xbox, with it being one of the first games to utilize Microsoft's Xbox Live.[33]

Though based on its predecessor, this generation saw a notable advance in rendering terms as well as new improvements to the tool set.[38] Capable of running levels nearly 100 times more detailed than those found in *Unreal*, the engine integrated a variety of features, including a cinematic editing tool, particle systems, export plug-ins for 3D Studio Max and Maya, and a skeletal animation system first showcased in the PlayStation 2 version of *Unreal Tournament*.[39][40] In addition, the user interface for UnrealEd was rewritten in C++ using the wxWidgets toolkit, which Sweeney said was the "best thing available" at the time.[3]

Physical simulations, such as ragdoll player collisions and arbitrary rigid body dynamics, were powered by the Karma physics engine.[40][33] With *Unreal Tournament 2004*, vehicle-based gameplay was successfully implemented, enabling large-scale combat.[33][41] While *Unreal Tournament 2003* had support for vehicle physics through the Karma engine, as demonstrated by a testmap with a "hastily-constructed vehicle", it wasn't until Psyonix created a modification out of Epic's base code that the game received fully coded vehicles. Impressed by their efforts, Epic decided to include it in its successor as a new game mode under the name Onslaught by hiring Psyonix as a contractor.[40][42][43] Psyonix would later develop *Rocket League* before being acquired by Epic in 2019.[44]

A specialized version of UE2 called UE2X was designed for *Unreal Championship 2: The Liandri Conflict* on the original Xbox platform, featuring optimizations specific to that console.[45] In March 2011, Ubisoft Montreal revealed that UE2 was successfully running on the Nintendo 3DS via *Tom Clancy's Splinter Cell 3D*.[46] "The 3DS is powerful, and we are able to run the Unreal Engine on this console, which is pretty impressive for a handheld machine, and the 3D doesn't affect the performance (thanks to my amazing programmers)," said Ubisoft.[46]

Unreal Engine 3

Screenshots of Unreal Engine 3 were presented by July 2004, at which point the engine had already been in development for over 18 months.[47] The engine was based on the first-generation, but contained new features. "The basic architectural decisions visible to programmers of an object-oriented design, a data-driven scripting approach, and a fairly modular approach to subsystems still remain [from Unreal Engine 1]. But the parts of the game that are really visible to gamers –the renderer, the physics system, the sound system, and the tools– are all visibly new and dramatically more powerful," said Sweeney.[48] Unlike Unreal Engine 2, which still supported a fixed-function pipeline, Unreal Engine 3 was designed to take advantage of fully programmable shader hardware.[48] All lighting and shadowing calculations were done per-pixel, instead of per-vertex. On the rendering side, Unreal Engine 3 provided support for a gamma-correct high-dynamic range renderer.[48] The first games released using Unreal Engine 3 were *Gears of War* for Xbox 360, and *RoboBlitz* for Windows, which were both released on November 7, 2006.[49]

Initially, Unreal Engine 3 only supported Windows, PlayStation 3, and Xbox 360 platforms, while iOS (first demonstrated with Epic Citadel) and Android were added later in 2010, with *Infinity Blade* being the first iOS title and *Dungeon Defenders* the first Android title.[50][51] In 2011, it was announced that the engine would support Adobe Flash Player 11 through the Stage 3D hardware-accelerated APIs and that it was being used in two Wii U games, *Batman: Arkham City* and *Aliens: Colonial Marines*.[52][53] In 2013,

Epic teamed-up with Mozilla to bring Unreal Engine 3 to the web; using the asm.js sublanguage and Emscripten compiler, they were able to port the engine in four days.[54]

Throughout the lifetime of UE3, significant updates were incorporated,[55] including improved destructible environments, soft body dynamics, large crowd simulation, iOS functionality,[56] Steamworks integration,[57] a real-time global illumination solution,[58][59] and stereoscopic 3D on Xbox 360 via TriOviz for Games Technology.[60][61][62] DirectX 11 support was demonstrated with the *Samaritan* demo, which was unveiled at the 2011 Game Developers Conference and built by Epic Games in a close partnership with Nvidia, with engineers working around the country to push real-time graphics to a new high point.[63][64][65]


Screenshot of the *Samaritan* demo

Unreal Development Kit

While Unreal Engine 3 was quite open for modders to work with, the ability to publish and sell games meant using UE3 was restricted to licenses of the engine. However, in November 2009, Epic released a free version of UE3's SDK, called the Unreal Development Kit (UDK), that is available to the general public.[66]

In December 2010, the kit was updated to include support for creating iOS games and apps.[67] OS X compatibility followed in the September 2011 release.[68]

Unreal Engine 4
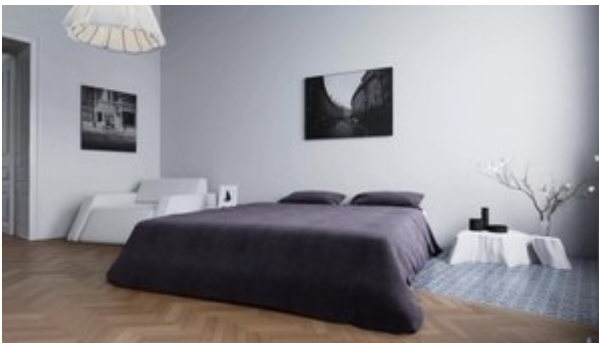
Play media
Interactive architectural visualization developed with Unreal Engine 4 (2015)

In August 2005, Mark Rein, the vice-president of Epic Games, revealed that Unreal Engine 4 had been in development for two years.[69] "People don't realise this but we're already two years into development of Unreal Engine 4. It certainly doesn't have a full team yet, it's just one guy and you can probably guess who that guy is," he told *C&VG*.[70] Speaking in an interview in early 2008, Sweeney stated that he was basically the only person working on the engine, though he affirmed his research and development department would start to expand later that year, designing the engine in parallel with the efforts by the UE3 team.[71] In February 2012, Rein said "people are going to be shocked later this year when they see Unreal Engine 4";[72] Epic unveiled UE4 to limited attendees at the 2012 Game Developers Conference,[73] and a video of the engine being demonstrated by technical artist Alan Willard was released to the public on June 7, 2012, via GameTrailers TV.[74]

One of the major features planned for UE4 was real-time global illumination using voxel cone tracing, eliminating pre-computed lighting.[75] However, this feature, called Sparse Voxel Octree Global Illumination (SVOGI) and showcased with the *Elemental* demo, was replaced with a similar but less computationally expensive algorithm due to performance concerns.[76] UE4 also includes the new

"Blueprints" visual scripting system (a successor to UE3's "Kismet"[77]), which allows for rapid development of game logic without using code, resulting in less of a divide between technical artists, designers, and programmers.[78][79]

> I could say: 'I'm going to convert this pillar into a blueprint [in the Engine] and add some sort of trap to it.' It means I can really go in and start enhancing my world with interaction that just would not have been possible without a technical artist, a designer and a programmer and now any one of those three can do all of it, provided they have the assets handy. The fact that I can just go in and say, 'If you're within X distance of this thing, start to glow and take my distance to it, normalize it zero to one and then just lerp [oscillate] between two different brightness values, so as I reach for something it gets hot'...that would have been something do-able but very difficult for anybody except a gameplay programmer. And he wouldn't have known how to set up the assets, but now any one of the three could do it.
>
> — Willard, *Kotaku,* 2012[79]

On March 19, 2014, at the Game Developers Conference (GDC), Epic Games released Unreal Engine 4 through a new licensing model. For a monthly subscription at US$19, developers were given access to the full version of the engine, including the C++ source code, which could be downloaded via GitHub. Any released product was charged with a 5% royalty of gross revenues.[80] The first game released using Unreal Engine 4 was *Daylight*, developed with early access to the engine[81] and released on April 29, 2014.[82]


An Unreal Engine presentation at GDC 2016

On September 4, 2014, Epic released Unreal Engine 4 to schools and universities for free, including personal copies for students enrolled in accredited video game development, computer science, art, architecture, simulation, and visualization programs.[83] Epic opened an Unreal Engine Marketplace for acquiring game assets.[84] On February 19, 2015, Epic launched *Unreal Dev Grants*, a $5 million development fund aiming to provide grants to creative projects using Unreal Engine 4.[85]

In March 2015, Epic released Unreal Engine 4, along with all future updates, for free for all users.[86][87] In exchange, Epic established a selective royalty schedule, asking for 5% of revenue for products that make more than $3,000 per quarter.[88] Sweeney stated that when they moved to the subscription model in 2014, use of Unreal grew by 10 times and through many smaller developers, and believed that they would draw even more uses through this new pricing scheme.[89]

In an attempt to attract Unreal Engine developers, Oculus VR announced in October 2016 that it will pay royalty fees for all Unreal-powered Oculus Rift titles published on their store for up to the first $5 million of gross revenue per game.[90]

To prepare for the release of its free-to-play battle royale mode in *Fortnite* in September 2017, Epic had to make a number of Unreal Engine modifications that helped it to handle a large number (up to 100) of connections to the same server while still retaining high bandwidth, and to improve the rendering of a large open in-game world. Epic said it would incorporate these changes into future updates of the Unreal Engine.[91]
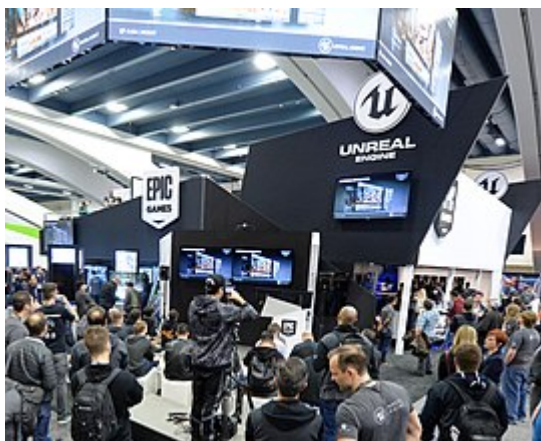
An Unreal Engine booth at GDC 2017

With the opening of the Epic Games Store in December 2018, Epic will not charge the 5% revenue fee on games that use the Unreal Engine and released through the Epic Games Stores, absorbing that cost as part of the base 12% cut Epic is taking to cover other costs.[92]

Effective May 13, 2020, and retroactive to January 1, 2020, the royalty exemption amount is increased to US$1,000,000 in lifetime gross revenue per title.[93]

The engine officially supports the following platforms as of 4.26:[94]

- Microsoft Windows,[95] macOS,[95] Linux,[95]
- iOS,[95] Android,[95] HTML5[96]
- Nintendo Switch,[97] PlayStation 4,[98] Xbox One,[98] PlayStation 5,[99] Xbox Series X/S,[99] and Stadia.[100]
- Magic Leap,[101] HTC Vive,[102] Oculus,[103] PlayStation VR,[104] OSVR,[105] Samsung Gear VR,[106] and HoloLens 2.[107]

It formerly officially supported Google Daydream.[108]

Unreal Engine 5

Unreal Engine 5 was revealed on May 13, 2020, supporting all existing systems including the next-generation consoles PlayStation 5 and Xbox Series X/S.[109] Work on the engine started about two years prior to its announcement.[110] It was released in early access on May 26, 2021, with expected full launch in early 2022.[111]

One of its major features is Nanite, an engine that allows for high-detailed photographic source material to be imported into games.[112] The Nanite virtualized geometry technology allows Epic to take advantage of its past acquisition of Quixel, the world's largest photogrammetry library as of 2019. The goal of Unreal Engine 5 was to make it as easy as possible for developers to create detailed

The cave system in the "Lumen in the Land of Nanite" Unreal Engine 5 demo was generated using real-world photogrammetry assets imported into the Nanite engine rather than detailed by hand.

game worlds without having to spend excessive time on creating new detailed assets, allowing the engine software to handle these factors.[110] Nanite can import nearly any other pre-existing three-dimension representation of objects and environments, including ZBrush and CAD models, allowing the use of film-quality assets.[113] Nanite automatically handles the levels of detail (LODs) of these imported objects appropriate to the target platform and draw distance, a task that an artist would have had to perform otherwise.[114] Lumen is another component described as a "fully dynamic global illumination solution that immediately reacts to scene and light changes".[114][112][115] Lumen eliminates the need for artists and developers to craft a lightmap for a given scene, but instead calculates light reflections and shadows on the fly, thus allowing for real-time behavior of light sources.[114] Additional components include Niagara for fluid and particle dynamics and Chaos for a physics engine.[110]

With potentially tens of billions of polygons present on a single screen at 4k resolution, Epic also developed the Unreal Engine 5 to take advantage of the upcoming high-speed storage solutions with the next-generation console hardware that will use a mix of RAM and custom solid-state drives.[114] Epic had worked closely with Sony in optimizing Unreal Engine 5 for the PlayStation 5, with Epic collaborating with Sony on the console's storage architecture.[116] To demonstrate the ease of creating a detailed world with minimal effort, the May 2020 reveal of the engine showcased a demo called "Lumen in the Land of Nanite" running on a PlayStation 5 that was built mostly by pulling assets from the Quixel library and using the Nanite, Lumen, and other Unreal Engine 5 components to create a photorealistic cave setting that could be explored.[110][117] Epic affirmed that Unreal Engine 5 would be fully supported on the Xbox Series X as well, but had been focused on the PlayStation 5 during the announcement as a result of their work with Sony in the years prior.[118] Epic plans to use *Fortnite* as a testbed for Unreal Engine 5 to showcase what the engine can do to the industry, with the game expected to use the engine by mid-2021.[110][119] Ninja Theory's *Senua's Saga: Hellblade II* will also be one of the first games to use Unreal Engine 5.[120]

Additional features planned for Unreal Engine 5 come from Epic's acquisitions and partnerships. The MetaHuman Creator is a project based on technology from three companies acquired by Epic, 3Lateral, Cubic Motion, and Quixel, to allow developers to quickly create realistic human characters that can then be exported for use within Unreal.[121] Through partnership with Cesium, Epic plans to offer a free plugin to provide 3D geospatial data for Unreal users, allowing them to recreate any part of the mapped surface of Earth.[122] Epic will include RealityCapture, a product it acquired with its acquisition of Capturing Reality that can generate 3D models of any object from a collection of photographs taken of it from multiple angles,[123] and the various middleware tools offered by RAD Game Tools.[124]

Unreal Engine 5 will retain the current royalty model, with developers returning 5% of gross revenues to Epic Games, though this fee is forgiven for those that release their games on the Epic Games Store. Further, Epic announced alongside Unreal Engine 5 that they will not take any fee from games using any version of Unreal Engine for the first US$1 million in gross revenue, retroactive to January 1, 2020.[125]

UnrealScript

UnrealScript (often abbreviated to UScript) was Unreal Engine's native scripting language used for authoring game code and gameplay events before the release of Unreal Engine 4. The language was designed for simple, high-level game programming.[126] The UnrealScript interpreter was programmed by Sweeney, who also created an earlier game scripting language, ZZT-oop.[11]

Similar to Java, UnrealScript was object-oriented without multiple inheritance (classes all inherit from a common Object class), and classes were defined in individual files named for the class they define. Unlike Java, UnrealScript did not have object wrappers for primitive types. Interfaces were only supported in Unreal Engine generation 3 and a few Unreal Engine 2 games. UnrealScript supported operator overloading, but not method overloading, except for optional parameters.

At the 2012 Game Developers Conference, Epic announced that UnrealScript was being removed from Unreal Engine 4 in favor of C++.[127] Visual scripting would be supported by the

UnrealScript	
Paradigm	Object-oriented, generic
Developer	Tim Sweeney
First appeared	May 1998
Typing discipline	Static, strong, safe
OS	Cross-platform (multi-platform)
Filename extensions	.uc .uci .upkg
Website	docs.unrealengine.com (https://docs.unrealengine.com/udk/Three/UnrealScriptHome.html)
Influenced by	
C++, Java	

Blueprints Visual Scripting system, a replacement for the earlier Kismet visual scripting system.[7][77]

> One of the key moments in Unreal Engine 4's development was, we had a series of debates about UnrealScript – the scripting language I'd built that we'd carried through three generations. And what we needed to do to make it competitive in the future. And we kept going through bigger and bigger feature lists of what we needed to do to upgrade it, and who could possibly do the work, and it was getting really, really unwieldy. And there was this massive meeting to try and sort it out, and try to cut things and decide what to keep, and plan and...there was this point where I looked at that and said 'you know, everything you're proposing to add to UnrealScript is already in C++. Why don't we just kill UnrealScript and move to pure C++? You know, maximum performance and maximum debuggability. It gives us all these advantages.'
>
> — Sweeney, *Gamasutra*, 2017[128]

Marketplace

With Unreal Engine 4, Epic opened the Unreal Engine Marketplace in September 2014. The Marketplace is a digital storefront that allows content creators and developers to provide art assets, models, sounds, environments, code snippets, and other features that others could purchase, along with tutorials and other guides. Some content is provided for free by Epic, including previously offered Unreal assets and tutorials.[129] Prior to July 2018, Epic took a 30% share of the sales but due to the success of Unreal and *Fortnite Battle Royale*, Epic retroactively reduced its take to 12%.[130]

Usage

Video games

The Unreal Engine was primarily designed to be used as the main game engine in video games. Besides Epic's own games, including *Gears of War* and *Fortnite*, the engine is used in a number of high-profile game titles, including *PlayerUnknown's Battlegrounds*, *Final Fantasy VII Remake*, *Valorant* and *Yoshi's Crafted World*.[131][132][133]

Film

The Unreal Engine has found use in film making to create virtual sets that can track with a camera's motion around actors and objects and be rendered in real time to large LED screens and atmospheric lighting systems. This allows for real-time composition of shots, immediate editing of the virtual sets as needed, and the ability to shoot multiple scenes within a short period by just changing the virtual world behind the actors. The overall appearance was recognized to appear more natural than typical chromakey effects.

Among the productions to use these technologies were the television series *The Mandalorian* and *Westworld*. Jon Favreau and Lucasfilm's Industrial Light & Magic division worked with Epic in developing their StageCraft technology for *The Mandalorian*, based on a similar approach Favreau had used in *The Lion King*.[134][135][136] Favreau then shared this technology approach with Jonathan Nolan and Lisa Joy, the producers for *Westworld*. The show had already looked at the use of virtual sets before and had some technology established, but integrated the use of Unreal Engine as with StageCraft for its third season.[137][138]

Orca Studios, a Spanish-based company, has been working with Epic to establish multiple studios for virtual filming similar to the StageCraft approach with Unreal Engine providing the virtual sets, particularly during the COVID-19 pandemic which restricted travel.[139]

In January 2021, *Deadline Hollywood* announced that Epic was using part of its Epic MegaGrants to back for the first time an animated feature film, *Gilgamesh*, to be produced fully in Unreal Engine by animation studios Hook Up, DuermeVela and FilmSharks.[140] As part of an extension of its MegaGrants, Epic also funded 45 additional projects since around 2020 for making movies and short films in the Unreal Engine.[141]

Other uses

Unreal Engine has also been used by non-creative fields due to its availability and feature sets. It has been used as a basis for a virtual reality tool to explore pharmaceutical drug molecules in collaboration with other researchers, as a virtual environment to explore and design new buildings and automobiles, and used for cable news networks to support real-time graphics.[142]

Legal aspects

The state of the Unreal Engine came up in Epic's 2020 legal action against Apple Inc. claiming anticompetitive behavior in Apple's iOS App Store. Epic had uploaded a version of *Fortnite* that violated Apple's App Store allowances. Apple, in response, removed the *Fortnite* app and later threatened to terminate Epic's developer accounts which would have prevented Epic from updating the Unreal Engine for iOS and macOS.[143] The judge agreed to grant Epic a permanent injunction against Apple to prevent Apple from taking this step, since the judge agreed that would impact numerous third-party developers that rely on the Unreal Engine.[144]

Awards

- Technology & Engineering Emmy Award from the National Academy of Television Arts and Sciences (NATAS) for "3D Engine Software for the Production of Animation" in 2018[145]
- Primetime Engineering Emmy Award from the Television Academy for exceptional developments in broadcast technology in 2020[146]
- Annie Award from ASIFA-Hollywood for technical advancement in animation in 2021[147]
- *Game Developer Magazine* Front Line Award for Best Game Engine for 2004,[148] 2005,[149] 2006,[150] 2007,[151] 2009,[152] 2010,[153] 2011,[154] and 2012[155]
- Develop Industry Excellence Award for Best Engine for 2009,[156] 2010,[157] 2011,[158] 2013,[159] 2016,[160] 2017,[161] and 2018[162]
- *Guinness World Record* for most successful video game engine[163]

See also

- List of Unreal Engine games
- 3D computer graphics

References

1. https://forums.unrealengine.com/unreal-engine/announcements-and-releases/1858635-4-

26-1-hotfix-released.

2. "Unreal Engine End User License Agreement" (https://www.unrealengine.com/en-US/eula). *Unreal Engine*. Archived (https://web.archive.org/web/20180826113400/https://www.unrealengine.com/en-US/eula) from the original on August 26, 2018. Retrieved August 26, 2018.

3. Lightbown, David (January 9, 2018). "Classic Tools Retrospective: Tim Sweeney on the first version of the Unreal Editor" (https://www.gamasutra.com/blogs/DavidLightbown/20180109/309414/Classic_Tools_Retrospective_Tim_Sweeney_on_the_first_version_of_the_Unreal_Editor.php). *Gamasutra*. Archived (https://web.archive.org/web/20180823012812/https://www.gamasutra.com/blogs/DavidLightbown/20180109/309414/Classic_Tools_Retrospective_Tim_Sweeney_on_the_first_version_of_the_Unreal_Editor.php) from the original on August 23, 2018. Retrieved August 22, 2018.

4. Sweeney, Tim (2005). "GPU Gems 2 – Foreword" (https://developer.nvidia.com/gpugems/GPUGems2/gpugems2_frontmatter.html). *Nvidia Developer*. Archived (https://web.archive.org/web/20171003225316/https://developer.nvidia.com/gpugems/GPUGems2/gpugems2_frontmatter.html) from the original on October 3, 2017. Retrieved October 3, 2017.

5. Edwards, Benj (May 25, 2009). "Features - From The Past To The Future: Tim Sweeney Talks" (https://www.gamasutra.com/view/feature/4035/from_the_past_to_the_future_tim_.php). *Gamasutra*. Archived (https://web.archive.org/web/20170809214002/http://www.gamasutra.com/view/feature/4035/from_the_past_to_the_future_tim_.php) from the original on August 9, 2017. Retrieved November 18, 2018.

6. Plante, Chris (October 1, 2012). "Better with age: A history of Epic Games" (https://www.polygon.com/2012/10/1/3438196/better-with-age-a-history-of-epic-games). *Polygon*. Retrieved August 19, 2020.

7. Nutt, Christian (March 21, 2014). "Epic's Tim Sweeney lays out the case for Unreal Engine 4" (https://www.gamasutra.com/view/news/213647/Epics_Tim_Sweeney_lays_out_the_case_for_Unreal_Engine_4.php). *Gamasutra*. Archived (https://web.archive.org/web/20171003225230/https://www.gamasutra.com/view/news/213647/Epics_Tim_Sweeney_lays_out_the_case_for_Unreal_Engine_4.php) from the original on October 3, 2017. Retrieved October 3, 2017.

8. Keighley, Geoffrey. "Blinded By Reality: The True Story Behind the Creation of Unreal" (https://web.archive.org/web/20010519154729/http://www.gamespot.com/features/makeunreal/). *GameSpot*. Archived from the original (http://www.gamespot.com/features/makeunreal/) on May 19, 2001. Retrieved October 3, 2017.

9. Horvath, Stu (May 17, 2012). "The Imagination Engine: Why Next-Gen Videogames Will Rock Your World" (https://www.wired.com/2012/05/ff_unreal4/all/). *Wired*. Condé Nast. **20** (6). Archived (https://web.archive.org/web/20150530075446/http://www.wired.com/2012/05/ff_unreal4/all/) from the original on May 30, 2015. Retrieved February 6, 2015.

10. Brightman, James (March 13, 2012). "An Epic Interview With Tim Sweeney" (https://www.gamesindustry.biz/articles/2012-03-13-an-epic-interview-with-tim-sweeney). *GamesIndustry.biz*. Archived (https://web.archive.org/web/20190709094857/https://www.gamesindustry.biz/articles/2012-03-13-an-epic-interview-with-tim-sweeney) from the original on July 9, 2019. Retrieved July 9, 2019.

11. Thomsen, Mike (February 23, 2010). "History of the Unreal Engine" (https://web.archive.org/web/20170712132329/http://www.ign.com/articles/2010/02/23/history-of-the-unreal-engine). *IGN*. Archived from the original (http://www.ign.com/articles/2010/02/23/history-of-the-unreal-engine) on July 12, 2017. Retrieved August 13, 2017.

12. Lily, Paul (July 21, 2009). "Doom to Dunia: A Visual History of 3D Game Engines" (https://web.archive.org/web/20090724065520/http://www.maximumpc.com/article/features/3d_game_engines?page=0%2C3). Maximum PC. Archived from the original (http://www.maximumpc.com/article/features/3d_game_engines?page=0%2C3) on July 24, 2009. Retrieved July 5, 2009.

13. Wilson, Billy (October 23, 1998). "Talkin' nasty with Epic's code-p1mp, Tim Sweeney" (http s://web.archive.org/web/19990501170629/http://www.voodooextreme.com/articles/interview _ts.html). *Voodoo Extreme*. Archived from the original (http://www.voodooextreme.com/articl es/interview_ts.html) on May 1, 1999. Retrieved July 20, 2019.

14. O'Brien, Chris; Wilson, Billy (March 28, 2000). "Ask Sweeney, part 2" (https://web.archive.or g/web/20000815211043/http://www.voodooextreme.com/games/interviews/tims4.html). *Voodoo Extreme*. Archived from the original (http://www.voodooextreme.com/games/intervie ws/tims4.html) on August 15, 2000. Retrieved July 20, 2019.

15. Brandon, Alexander (2004). *Audio for Games: Planning, Process, and Production*. New Riders. p. 70. ISBN 9780735714137.

16. "Interview - Carlo Vogelsang on Lightning Quick 3D Audio with OpenAL" (https://web.archiv e.org/web/20030810051215/http://developer.creative.com/articles/article.asp?cat=1&sbcat= 31&top=38&aid=95). *Creative Labs*. June 30, 2003. Archived from the original (http://develo per.creative.com/articles/article.asp?cat=1&sbcat=31&top=38&aid=95) on August 10, 2003. Retrieved July 8, 2019.

17. Brandon, Alexander (March 27, 1998). "Interactive Music: Merging Quality with Effectiveness" (https://www.gamasutra.com/view/feature/131670/interactive_music_merging _quality_.php). *Gamasutra*. Archived (https://web.archive.org/web/20200220215719/https:// www.gamasutra.com/view/feature/131670/interactive_music_merging_quality_.php) from the original on February 20, 2020. Retrieved February 20, 2020.

18. "Next gen engines" (https://web.archive.org/web/20011121083307/http://www.tolstiy.ag.ru/w hat/sweeney.htm). *Tolstiy's Place*. Archived from the original (http://www.tolstiy.ag.ru/what/sw eeney.htm) on November 21, 2001. Retrieved August 7, 2020.

19. Edwards, Benj (February 19, 2021). "Before Fortnite, There Was ZZT: Meet Epic's First Game" (https://www.howtogeek.com/713532/before-fortnite-there-was-zzt-meet-epics-first-ga me/). *How-To Geek*. Retrieved March 23, 2021.

20. Smith, Tom (July 16, 2013). "Unreal: Epic's would-be Doom... er... Quake killer" (https://www. theregister.co.uk/2013/07/16/antique_code_show_unreal/). *The Register*. Archived (https://w eb.archive.org/web/20170812222508/http://www.theregister.co.uk/2013/07/16/antique_code _show_unreal/) from the original on August 12, 2017. Retrieved August 13, 2017.

21. Wilson, Billy; O'Brien, Chris; Heir, Manveer; Howarth, Robert (May 25, 2000). "Talkin' nasty with Epic's Tim Sweeney" (https://web.archive.org/web/20000620093601/http://www.voodoo extreme.com/games/interviews/timsweeney.html). *Voodoo Extreme*. Archived from the original (http://www.voodooextreme.com:80/games/interviews/timsweeney.html) on June 20, 2000. Retrieved August 13, 2017.

22. IGN Staff (August 10, 2001). "Harry Potter and the Sorcerer's Stone" (https://www.ign.com/art icles/2001/08/09/harry-potter-and-the-sorcerers-stone-12). *IGN*. Retrieved August 25, 2020.

23. "Tim Sweeney of Epic Games" (https://www.eurogamer.net/articles/sweeney). *Eurogamer*. October 28, 1999. Retrieved April 16, 2020.

24. Kosak, Dave. "Beyond Unreal" (https://web.archive.org/web/20010621202712/http://www.ga mespy.com/legacy/interviews/sweeney_a.shtm). *GameSpy*. Archived from the original (http:// www.gamespy.com/legacy/interviews/sweeney_a.shtm) on June 21, 2001. Retrieved April 16, 2020.

25. "This Is Unreal Tournament" (https://web.archive.org/web/19991112173407/http://www.next-generation.com/jsmid/news/6387.html). *Next Generation*. April 16, 1999. Archived from the original (http://www.next-generation.com/jsmid/news/6387.html) on November 12, 1999. Retrieved January 24, 2021.

26. Herz, J.C. (December 2, 1999). "GAME THEORY; For Game Maker, There's Gold in the Code" (https://www.nytimes.com/1999/12/02/technology/game-theory-for-game-maker-there-s-gold-in-the-code.html). *The New York Times*. Archived (https://web.archive.org/web/20170919141813/http://www.nytimes.com/1999/12/02/technology/game-theory-for-game-maker-there-s-gold-in-the-code.html) from the original on September 19, 2017. Retrieved September 24, 2017.

27. IGN Staff (October 9, 2000). "Unreal Tournament" (http://www.ign.com/articles/2000/10/10/unreal-tournament-3). *IGN*. Archived (https://web.archive.org/web/20160717214724/http://www.ign.com/articles/2000/10/10/unreal-tournament-3) from the original on July 17, 2016. Retrieved August 10, 2017.

28. IGN Staff (December 8, 2000). "Interview With Dreamcast Unreal Tournament Team" (http://uk.ign.com/articles/2000/12/09/interview-with-dreamcast-unreal-tournament-team). *IGN*. Archived (https://web.archive.org/web/20191009101410/https://uk.ign.com/articles/2000/12/09/interview-with-dreamcast-unreal-tournament-team) from the original on October 9, 2019. Retrieved August 10, 2017.

29. Thompson, Clive (December 21, 2009). "Learn to Let Go: How Success Killed Duke Nukem" (https://www.wired.com/2009/12/fail-duke-nukem/). *Wired*. Archived (https://web.archive.org/web/20200502124232/https://www.wired.com/2009/12/fail-duke-nukem/) from the original on May 2, 2020. Retrieved May 2, 2020.

30. Lightbown, David (October 23, 2018). "Classic Tools Retrospective: The tools that built Deus Ex, with Chris Norden" (https://www.gamasutra.com/blogs/DavidLightbown/20181023/328687/Classic_Tools_Retrospective_The_tools_that_built_Deus_Ex_with_Chris_Norden.php). *Gamasutra*. Archived (https://web.archive.org/web/20190629134018/https://www.gamasutra.com/blogs/DavidLightbown/20181023/328687/Classic_Tools_Retrospective_The_tools_that_built_Deus_Ex_with_Chris_Norden.php) from the original on June 29, 2019. Retrieved June 29, 2019.

31. Reinhart, Brandon. "Postmortem: Epic Games' Unreal Tournament" (https://www.gamasutra.com/view/feature/131569/postmortem_epic_games_unreal_.php?print=1). *Gamasutra*. Archived (https://web.archive.org/web/20170729182148/http://www.gamasutra.com/view/feature/131569/postmortem_epic_games_unreal_.php?print=1) from the original on July 29, 2017. Retrieved February 4, 2018.

32. "History of Unreal - Part 1" (http://www.beyondunreal.com/articles/history-of-unreal-part-1/?page=2). beyondunreal.com. May 31, 2005. Archived (https://web.archive.org/web/20110707231206/http://www.beyondunreal.com/articles/history-of-unreal-part-1/?page=2) from the original on July 7, 2011. Retrieved July 5, 2009. "*Probably the biggest draw to Unreal was the ability to mod it. Tim Sweeney (Founder of Epic) wrote a simple scripting engine into the game called UnrealScript.*"

33. Busby, Jason; Parrish, Zak; Wilson, Jeff (July 21, 2009). *Introduction to Unreal Technology* (http://www.informit.com/articles/article.aspx?p=1377834). InformIT. Archived (https://web.archive.org/web/20120930102826/http://www.informit.com/articles/article.aspx?p=1377834) from the original on September 30, 2012. Retrieved August 8, 2009.

34. McDonald, T. Liam (November 1998). "Game Theory" (https://books.google.com/books?id=1AEAAAAAMBAJ&q=Tim+Sweeney+epic&pg=PT8). *Maximum PC*. Vol. 3 no. November 1998. p. 43. ISSN 1522-4279 (https://www.worldcat.org/issn/1522-4279). Archived (https://web.archive.org/web/20191016081841/https://books.google.com/books?id=1AEAAAAAMBAJ&lpg=PT8&dq=Tim%20Sweeney%20epic&pg=PT8#v=onepage&q=Tim%20Sweeney%20epic&f=false) from the original on October 16, 2019. Retrieved September 17, 2017.

35. "Tim Sweeney Looks Ahead" (https://www.ign.com/articles/1998/10/24/tim-sweeney-looks-ahead). *IGN*. October 23, 1998. Archived (https://web.archive.org/web/20190627200603/https://www.ign.com/articles/1998/10/24/tim-sweeney-looks-ahead) from the original on June 27, 2019. Retrieved June 27, 2019.

36. McLeroy, Carrie (August 27, 2008). "Improving "America's Army" " (https://www.army.mil/artic le/11935/improving_americas_army). *U.S. Army*. Archived (https://web.archive.org/web/201 71119173617/https://www.army.mil/article/11935/improving_americas_army) from the original on November 19, 2017. Retrieved August 11, 2017.

37. Kennedy, Brian (July 11, 2002). "Uncle Sam Wants You (To Play This Game)" (https://www.n ytimes.com/2002/07/11/technology/uncle-sam-wants-you-to-play-this-game.html). *The New York Times*. Archived (https://web.archive.org/web/20171213224023/http://www.nytimes.co m/2002/07/11/technology/uncle-sam-wants-you-to-play-this-game.html) from the original on December 13, 2017. Retrieved December 12, 2017.

38. McLean-Foreman, John (April 6, 2001). "An Interview with Epic Games' Tim Sweeney" (htt p://www.gamasutra.com/view/feature/131502/an_interview_with_epic_games_tim_.php). *Gamasutra*. Archived (https://web.archive.org/web/20170822195226/http://www.gamasutra.c om/view/feature/131502/an_interview_with_epic_games_tim_.php) from the original on August 22, 2017. Retrieved August 22, 2017.

39. McDonald, Thomas L. "Gentlemen, Start Your Engines!" (https://archive.org/details/Maximu m_PC_January_2001). *Maximum PC*. No. January 2001. p. 44 (https://archive.org/details/M aximum_PC_January_2001/page/n45).

40. Planet Unreal (October 22, 2002). "Tim Sweeney & CliffyB Interview" (https://web.archive.or g/web/20021024164903/http://www.planetunreal.com/features/ut2interview/page2.shtml). *Planet Unreal*. Archived from the original (http://www.planetunreal.com:80/features/ut2intervi ew/page2.shtml) on October 24, 2002. Retrieved September 27, 2017.

41. Parker, Sam (March 16, 2004). "Unreal Tournament 2004 Review" (https://www.gamespot.co m/reviews/unreal-tournament-2004-review/1900-6091581/). *GameSpot*. Archived (https://we b.archive.org/web/20190711123252/https://www.gamespot.com/reviews/unreal-tournament-2004-review/1900-6091581/) from the original on July 11, 2019. Retrieved July 11, 2019.

42. hal (March 24, 2004). "BU Interviews: Psyonix" (https://www.beyondunreal.com/articles/bu-in terviews-psyonix/). *BeyondUnreal*. Archived (https://web.archive.org/web/20161115194304/ https://www.beyondunreal.com/articles/bu-interviews-psyonix/) from the original on November 15, 2016. Retrieved November 29, 2016.

43. Wawro, Alex (July 21, 2015). "Why some old designs are worth revisiting: A Rocket League story" (https://www.gamasutra.com/view/news/248925/Why_some_old_designs_are_worth_ revisiting_A_Rocket_League_story.php). *Gamasutra*. Archived (https://web.archive.org/web/ 20190511100808/https://www.gamasutra.com/view/news/248925/Why_some_old_designs_ are_worth_revisiting_A_Rocket_League_story.php) from the original on May 11, 2019. Retrieved July 11, 2019.

44. Statt, Nick (May 1, 2019). "Epic buys Rocket League developer Psyonix, strongly hints it will stop selling the game on Steam" (https://www.theverge.com/2019/5/1/18525842/epic-games -psyonix-acquisition-rocket-league-fortnite-unreal-deal). *The Verge*. Archived (https://web.ar chive.org/web/20190501194904/https://www.theverge.com/2019/5/1/18525842/epic-games-psyonix-acquisition-rocket-league-fortnite-unreal-deal) from the original on May 1, 2019. Retrieved July 11, 2019.

45. Edge Australia. "The unreal thing" (https://archive.org/stream/Edge-AUS-01-2004-10#page/ n67/mode/2up/search/Unreal+Engine+2X). *Edge Australia*. No. 1. p. 68. Retrieved August 26, 2017.

46. Parrish, Kevin (March 25, 2011). "Ubisoft: 3DS Can Handle Unreal Engine 2" (http://www.to msguide.com/us/Unreal-Engine-2-Splinter-Cell-3DS-Nitendo-3DS,news-10601.html). *Tom's Guide*. Archived (https://web.archive.org/web/20160121043753/http://www.tomsguide.com/u s/Unreal-Engine-2-Splinter-Cell-3DS-Nitendo-3DS%2Cnews-10601.html) from the original on January 21, 2016. Retrieved January 28, 2016.

47. Reed, Kristan (July 1, 2004). "Unreal Engine 3 Interview" (http://www.eurogamer.net/articles/ i_epicgames_june04). *Eurogamer*. Archived (https://web.archive.org/web/20130315080605/ http://www.eurogamer.net/articles/i_epicgames_june04) from the original on March 15, 2013.

48. Maximum PC. "Game Engines – Exposed!" (https://archive.org/details/Maximum_PC_Autum n_2004). *Maximum PC*. No. Fall 2004 (Special ed.). Future US. pp. 59 (https://archive.org/de tails/Maximum_PC_Autumn_2004/page/n60), 62–64. Archived (https://web.archive.org/web/ 20191016081830/https://archive.org/details/Maximum_PC_Autumn_2004) from the original on October 16, 2019. Retrieved August 11, 2017.

49. Caron, Frank (March 13, 2008). "Unreal Engine 4 to "exclusively target" next-gen consoles" (https://arstechnica.com/gaming/2008/03/unreal-engine-4-to-exclusively-target-next-gen-con soles/). *Ars Technica*. Archived (https://web.archive.org/web/20190123071502/https://arstec hnica.com/gaming/2008/03/unreal-engine-4-to-exclusively-target-next-gen-consoles/) from the original on January 23, 2019. Retrieved January 22, 2019.

50. Crossley, Rob (December 20, 2010). "Unreal Engine 3 game comes to Android [Update 1]" (http://www.develop-online.net/news/unreal-engine-3-game-comes-to-android-update-1/010 8386). *Develop*. Archived (https://web.archive.org/web/20170811205259/http://www.develop -online.net/news/unreal-engine-3-game-comes-to-android-update-1/0108386) from the original on August 11, 2017. Retrieved August 11, 2017.

51. De Vere, Kathleen (January 6, 2012). "A Top-Grossing iOS Game Like Epic's Infinity Blade II Can Earn More Than $5 Million a Month" (http://www.adweek.com/digital/a-top-grossing-ios- game-like-epic%E2%80%99s-infinity-blade-ii-can-earn-more-than-5-million-a-month/). *Adweek*. Archived (https://web.archive.org/web/20170811204830/http://www.adweek.com/di gital/a-top-grossing-ios-game-like-epic%E2%80%99s-infinity-blade-ii-can-earn-more-than-5- million-a-month/) from the original on August 11, 2017. Retrieved August 11, 2017.

52. Sottek, T.C. (October 7, 2011). "Adobe Flash 11 adopts Unreal Engine 3 for better browser games" (https://www.theverge.com/2011/10/7/2471974/epics-unreal-3-engine-coming-soon- to-adobe-flash-11). *The Verge*. Archived (https://web.archive.org/web/20170706225700/http s://www.theverge.com/2011/10/7/2471974/epics-unreal-3-engine-coming-soon-to-adobe-fla sh-11) from the original on July 6, 2017. Retrieved August 11, 2017.

53. Crossley, Rob (June 7, 2011). "Wii U powered by Unreal Engine 3 tech" (http://www.develop -online.net/news/wii-u-powered-by-unreal-engine-3-tech/0109499). *Develop*. Archived (http s://web.archive.org/web/20170811234035/http://www.develop-online.net/news/wii-u-powere d-by-unreal-engine-3-tech/0109499) from the original on August 11, 2017. Retrieved August 12, 2017.

54. Ligman, Kris (May 2, 2013). "See Epic's Unreal Engine 3 running in HTML5" (http://www.ga masutra.com/view/news/191642/See_Epics_Unreal_Engine_3_running_in_HTML5.php). *Gamasutra*. Archived (https://web.archive.org/web/20170811231639/http://www.gamasutra.c om/view/news/191642/See_Epics_Unreal_Engine_3_running_in_HTML5.php) from the original on August 11, 2017. Retrieved August 12, 2017.

55. Callaham, John (March 19, 2009). "Epic Games to show off new Unreal Engine 3 features at GDC" (http://news.bigdownload.com/2009/03/16/epic-games-to-show-off-new-unreal-engine -3-features-at-gdc). Big Download. Archived (https://web.archive.org/web/20090318235456/ http://news.bigdownload.com/2009/03/16/epic-games-to-show-off-new-unreal-engine-3-feat ures-at-gdc/) from the original on March 18, 2009.

56. Shimpi, Anand Lal (December 29, 2009). "Epic Demonstrates Unreal Engine 3 for the iPod Touch, iPhone 3GS" (http://www.anandtech.com/show/2892). AnandTech. Archived (https:// web.archive.org/web/20120708104324/http://www.anandtech.com/show/2892) from the original on July 8, 2012.

57. "Steamworks Integration Now Available to Unreal Engine 3 Licensees" (https://web.archive. org/web/20100517122844/http://epicgames.com/press_releases/steamworks.html). Epic Games. March 11, 2010. Archived from the original (http://epicgames.com/press_releases/st eamworks.html) on May 17, 2010.

58. "Geomerics Enlighten" (http://www.unrealengine.com/news/geomerics_announces_new_en lighten_integration_with_unreal_engine_3/).

59. "Geomerics Announces New Enlighten Integration with Unreal Engine 3" (https://web.archiv e.org/web/20120605210049/http://www.unrealengine.com/news/geomerics_announces_ne w_enlighten_integration_with_unreal_engine_3/). Archived from the original (http://www.unr ealengine.com/news/geomerics_announces_new_enlighten_integration_with_unreal_engi ne_3/) on June 5, 2012. Retrieved June 12, 2012.

60. Ingham, Tim (June 17, 2010). "E3 2010: Epic makes 3D Gears Of War 2 - We've seen it. It's mega. But retail release not planned" (http://www.computerandvideogames.com/252372/ne ws/epic-makes-3d-gears-of-war-2/?attr=cvg-general-rss&skip=yes). *Computer and Video Games*. Archived (https://archive.today/20120728140333/http://www.computerandvideogam es.com/252372/news/epic-makes-3d-gears-of-war-2/?attr=cvg-general-rss&skip=yes) from the original on July 28, 2012. Retrieved February 12, 2011.

61. "TriOviz for Games Technology Brings 3D Capabilities to Unreal Engine 3" (https://web.archi ve.org/web/20120309110608/http://epicgames.com/news/darkworks-trioviz-for-games-sdk-b rings-3d-capabilities-to-unreal-engine-3). Epic Games. October 6, 2010. Archived from the original (http://www.epicgames.com/news/darkworks-trioviz-for-games-sdk-brings-3d-capabi lities-to-unreal-engine-3) on March 9, 2012.

62. Fletcher, JC (October 11, 2010). "Epic's Mark Rein goes in-depth with Unreal Engine 3's TriOviz 3D" (http://www.joystiq.com/2010/10/11/mark-rein-trioviz-interview/). Joystiq. Archived (https://web.archive.org/web/20120312142947/http://www.joystiq.com/2010/10/11/ mark-rein-trioviz-interview/) from the original on March 12, 2012.

63. Hamilton, Kirk (February 8, 2013). "Apparently, The Story Behind Epic's Dazzling 2011 Tech Demo Is A 'Doozy' " (https://kotaku.com/5982905/apparently-the-story-behind-epics-dazzling -2011-tech-demo-is-a-doozy). Kotaku. Archived (https://web.archive.org/web/201410060737 32/http://kotaku.com/5982905/apparently-the-story-behind-epics-dazzling-2011-tech-demo-i s-a-doozy) from the original on October 6, 2014. Retrieved October 4, 2014.

64. Gies, Arthur (March 18, 2014). "Epic Games working on new, unannounced IP (UPDATE)" (http://www.polygon.com/2014/3/18/5520112/epic-games-new-ip-samaritan). *Polygon*. Archived (https://web.archive.org/web/20141006071131/http://www.polygon.com/2014/3/18/ 5520112/epic-games-new-ip-samaritan) from the original on October 6, 2014. Retrieved October 4, 2014.

65. Gaudiosi, John (September 21, 2011). "Epic Games Founder Tim Sweeney Pushes Unreal Engine 3 Technology Forward" (https://www.forbes.com/sites/johngaudiosi/2011/09/21/epic- games-founder-tim-sweeney-pushes-unreal-engine-3-technology-forward/). *Forbes*. Archived (https://web.archive.org/web/20141007010938/http://www.forbes.com/sites/johnga udiosi/2011/09/21/epic-games-founder-tim-sweeney-pushes-unreal-engine-3-technology-for ward/) from the original on October 7, 2014. Retrieved October 4, 2014.

66. IGN Staff (November 5, 2009). "Epic Games Announces Unreal Development Kit, Powered By Unreal Engine 3" (http://www.ign.com/articles/2009/11/05/epic-games-announces-unreal -development-kit-powered-by-unreal-engine-3). *IGN*. Archived (https://web.archive.org/web/ 20140915025000/http://www.ign.com/articles/2009/11/05/epic-games-announces-unreal-de velopment-kit-powered-by-unreal-engine-3) from the original on September 15, 2014. Retrieved September 14, 2014.

67. IGN Staff (December 16, 2010). "Epic Games Releases Unreal Development Kit With iOS Support" (http://www.ign.com/articles/2010/12/16/epic-games-releases-unreal-development- kit-with-ios-support). *IGN*. Ziff Davis. Archived (https://web.archive.org/web/2014091502500 4/http://www.ign.com/articles/2010/12/16/epic-games-releases-unreal-development-kit-with-i os-support) from the original on September 15, 2014. Retrieved September 14, 2014.

68. Grant, Christopher (September 19, 2011). "Unreal Engine 3 comes to Mac OS X, courtesy of September UDK release" (http://www.joystiq.com/2011/09/19/unreal-engine-3-comes-to-ma c-os-x-courtesy-of-september-udk-rel/). Joystiq. Archived (https://web.archive.org/web/20120 119075057/http://www.joystiq.com/2011/09/19/unreal-engine-3-comes-to-mac-os-x-courtesy -of-september-udk-rel/) from the original on January 19, 2012.

69. Houlihan, John (August 18, 2005). "Rein: "We've been working on Unreal Engine 4 for two years" " (https://web.archive.org/web/20140110101539/http://www.computerandvideogames.com/123639/rein-weve-been-working-on-unreal-engine-4-for-two-years/). *Computer and Video Games*. Future Publishing Limited. Archived from the original (http://www.computerandvideogames.com/123639/rein-weve-been-working-on-unreal-engine-4-for-two-years/) on January 10, 2014. Retrieved August 19, 2005.

70. Howarth, Robert (August 18, 2005). "Unreal Engine 4?" (https://www.ign.com/articles/2005/08/17/unreal-engine-4). *IGN*. Retrieved September 9, 2020.

71. Valich, Theo (March 12, 2008). "Tim Sweeney, Part 3: Unreal Engine 4.0 aims at next-gen console war" (https://web.archive.org/web/20100414203822/http://www.tgdaily.com/business-and-law-features/36436-tim-sweeney-part-3-unreal-engine-40-aims-at-next-gen-console-war). *TG Daily*. Archived from the original (http://www.tgdaily.com/business-and-law-features/36436-tim-sweeney-part-3-unreal-engine-40-aims-at-next-gen-console-war) on April 14, 2010. Retrieved March 13, 2008.

72. Parrish, Kevin (February 11, 2012). "Epic Revealing Unreal Engine 4 Later This Year" (http://www.tomshardware.com/news/Epic-Games-Unreal-Engine-4-UE4-Mark-Rein-DICE-2012,14682.html). *Tom's Hardware*. Retrieved March 1, 2012.

73. Shaw, Patrick (February 27, 2012). "Unreal Engine 4 Behind Closed Doors at GDC" (https://www.wired.com/gamelife/2012/02/unreal-engine-4-gdc/). *Wired*. Archived (https://web.archive.org/web/20120301192419/http://www.wired.com/gamelife/2012/02/unreal-engine-4-gdc) from the original on March 1, 2012. Retrieved March 6, 2012.

74. "Unreal Engine 4 - GT.TV Exclusive Development Walkthrough" (https://www.youtube.com/watch?v=MOvfn1p92_8). GameTrailers TV. June 7, 2012. Archived (https://web.archive.org/web/20181123225848/https://www.youtube.com/watch?v=MOvfn1p92_8) from the original on November 23, 2018. Retrieved August 22, 2018 – via YouTube.

75. Burnes, Andre (June 7, 2012). "Epic Reveals Stunning Elemental Demo, & Tim Sweeney On Unreal Engine 4" (https://web.archive.org/web/20120610175656/http://www.geforce.com/whats-new/articles/stunning-videos-show-unreal-engine-4s-next-gen-gtx-680-powered-real-time-graphics/). *NVIDIA*. Archived from the original (http://www.geforce.com/whats-new/articles/stunning-videos-show-unreal-engine-4s-next-gen-gtx-680-powered-real-time-graphics/) on June 10, 2012. Retrieved June 12, 2012.

76. Papadopoulos, John (April 20, 2013). "Epic Games' Tim Sweeney Explains Lack Of 'SVOGI' In Unreal Engine 4" (https://www.dsogaming.com/news/epic-games-tim-sweeney-explains-lack-of-svogi-in-unreal-engine-4/). *Dark Side of Gaming*. Archived (https://web.archive.org/web/20200411192643/https://www.dsogaming.com/news/epic-games-tim-sweeney-explains-lack-of-svogi-in-unreal-engine-4/) from the original on April 11, 2020. Retrieved February 14, 2018.

77. Grayson, Nathan (July 20, 2012). "Fortnite's Jessen Talks Minecraft, PC Gaming, UE4" (https://www.rockpapershotgun.com/2012/07/20/fortnites-jessen-talks-minecraft-pc-gaming-ue4/). *Rock, Paper, Shotgun*. Archived (https://web.archive.org/web/20180501161305/https://www.rockpapershotgun.com/2012/07/20/fortnites-jessen-talks-minecraft-pc-gaming-ue4/) from the original on May 1, 2018. Retrieved May 1, 2018.

78. Thier, Dave (June 29, 2012). "Epic's Tim Sweeney on How Unreal Engine 4 Will Change The Way Games Are Made, and Why You Care" (https://www.forbes.com/sites/davidthier/2012/06/29/epics-tim-sweeney-on-how-unreal-engine-4-will-change-the-way-games-are-made-and-why-you-care/). *Forbes*. Archived (https://web.archive.org/web/20141006105926/http://www.forbes.com/sites/davidthier/2012/06/29/epics-tim-sweeney-on-how-unreal-engine-4-will-change-the-way-games-are-made-and-why-you-care/) from the original on October 6, 2014. Retrieved October 4, 2014.

79. Totilo, Stephen (June 8, 2012). "How Unreal Engine 4 Will Change The Next Games You Play" (https://kotaku.com/5916859/how-unreal-engine-4-will-change-the-next-games-you-play). Kotaku. Archived (https://web.archive.org/web/20121024091239/http://kotaku.com/5916859/how-unreal-engine-4-will-change-the-next-games-you-play) from the original on October 24, 2012.

80. Orland, Kyle (March 19, 2014). "Unreal Engine 4 now available as $19/month subscription with 5% royalty" (https://arstechnica.com/gaming/2014/03/unreal-engine-4-now-available-as-19month-subscription-with-5-royalty/). *Ars Technica*. Archived (https://web.archive.org/web/20180808171618/https://arstechnica.com/gaming/2014/03/unreal-engine-4-now-available-as-19month-subscription-with-5-royalty/) from the original on August 8, 2018. Retrieved August 8, 2018.

81. "Zombie Studios Licenses Unreal Engine 4" (https://www.unrealengine.com/en-US/blog/zombie-studios-licenses-unreal-engine-4). *unrealengine.com*. December 18, 2012. Archived (https://web.archive.org/web/20190123071622/https://www.unrealengine.com/en-US/blog/zombie-studios-licenses-unreal-engine-4) from the original on January 23, 2019. Retrieved January 23, 2019.

82. "Making it in Unreal: How Daylight survived public pressure and became the very first UE4 game" (https://www.pcgamesn.com/daylight/making-it-in-unreal-how-daylight-survived-public-pressure-and-became-the-very-first-ue4-game). *PCGamesN*. November 24, 2014. Archived (https://web.archive.org/web/20190123074403/https://www.pcgamesn.com/daylight/making-it-in-unreal-how-daylight-survived-public-pressure-and-became-the-very-first-ue4-game) from the original on January 23, 2019. Retrieved January 22, 2019.

83. Sykes, Tom (September 5, 2014). "Unreal Engine 4 now free for academic use" (https://www.pcgamer.com/unreal-engine-4-now-free-for-academic-use/). *PC Gamer*. Archived (https://web.archive.org/web/20180404200755/https://www.pcgamer.com/unreal-engine-4-now-free-for-academic-use/) from the original on April 4, 2018. Retrieved April 4, 2018.

84. Seppala, T. (September 5, 2014). "Would-be game makers can sell each other new levels, art in Unreal Engine 4" (https://www.engadget.com/2014-09-04-unreal-engine-4-marketplace.html). *Engadget*. Retrieved July 19, 2021.

85. Nutt, Christian (February 19, 2015). "Epic Games offers up $5 million in Unreal Dev Grants" (http://www.gamasutra.com/view/news/236807/Epic_Games_offers_up_5_million_in_Unreal_Dev_Grants.php). *Gamasutra*. UBM plc. Archived (https://web.archive.org/web/20150312070425/http://www.gamasutra.com/view/news/236807/Epic_Games_offers_up_5_million_in_Unreal_Dev_Grants.php) from the original on March 12, 2015. Retrieved March 11, 2015.

86. Sirani, Jordan (March 2, 2015). "Unreal Engine 4 is Free for Everyone" (http://www.ign.com/articles/2015/03/02/unreal-engine-4-is-free-for-everyone). *IGN*. Ziff Davis. Archived (https://web.archive.org/web/20150314224919/http://www.ign.com/articles/2015/03/02/unreal-engine-4-is-free-for-everyone) from the original on March 14, 2015. Retrieved March 12, 2015.

87. Nutt, Christian (March 2, 2015). "Unreal Engine 4 is now free-to-download for everyone" (http://www.gamasutra.com/view/news/237724/Unreal_Engine_4_is_now_freetodownload_for_everyone.php). *Gamasutra*. UBM plc. Archived (https://web.archive.org/web/20150315054400/http://www.gamasutra.com/view/news/237724/Unreal_Engine_4_is_now_freetodownload_for_everyone.php) from the original on March 15, 2015. Retrieved March 12, 2015.

88. Devin, Connors (September 3, 2014). "Epic Games Opens Unreal Engine Marketplace to Developers - Update" (http://www.escapistmagazine.com/news/view/137229-Epic-Games-Unreal-Engine-Marketplace-Open-UE4-Unreal-Tournament-2014). *The Escapist*. Archived (https://web.archive.org/web/20140905165442/http://www.escapistmagazine.com/news/view/137229-Epic-Games-Unreal-Engine-Marketplace-Open-UE4-Unreal-Tournament-2014) from the original on September 5, 2014. Retrieved August 21, 2018.

89. Gaudiosi, John (March 3, 2015). "Why Epic Games is giving away its game technology" (http://fortune.com/2015/03/03/epic-games-unreal-tech-free/). *Fortune*. Time Inc. Archived (https://web.archive.org/web/20150308142904/http://fortune.com/2015/03/03/epic-games-unreal-tech-free/) from the original on March 8, 2015. Retrieved March 13, 2015.

90. Graft, Kris (October 6, 2016). "Oculus, Epic make deal to give Unreal Engine devs a royalties break" (http://www.gamasutra.com/view/news/282872/Oculus_Epic_make_deal_to_give_Unreal_Engine_devs_a_royalties_break.php). *Gamasutra*. Archived (https://web.archive.org/web/20161030002552/http://www.gamasutra.com/view/news/282872/Oculus_Epic_make_deal_to_give_Unreal_Engine_devs_a_royalties_break.php) from the original on October 30, 2016. Retrieved October 29, 2016.

91. McAloon, Alissa (October 4, 2017). "Developing Fortnite: Battle Royale prompted engine-wide Unreal improvements" (https://www.gamasutra.com/view/news/307051/Developing_Fortnite_Battle_Royale_prompted_enginewide_Unreal_improvements.php). *Gamasutra*. Archived (https://web.archive.org/web/20180224221214/https://www.gamasutra.com/view/news/307051/Developing_Fortnite_Battle_Royale_prompted_enginewide_Unreal_improvements.php) from the original on February 24, 2018. Retrieved October 4, 2017.

92. Frank, Allegra (December 4, 2018). "Epic Games is launching its own store, and taking a smaller cut than Steam" (https://www.polygon.com/2018/12/4/18125498/epic-games-store-details-revenue-split-launch-date). *Polygon*. Archived (https://web.archive.org/web/20190120080823/https://www.polygon.com/2018/12/4/18125498/epic-games-store-details-revenue-split-launch-date) from the original on January 20, 2019. Retrieved December 7, 2018.

93. "Unreal Engine | Frequently Asked Questions" (https://www.unrealengine.com/en-US/faq). *Unreal Engine*. Retrieved July 23, 2020.

94. "Sharing and Releasing Projects" (https://docs.unrealengine.com/en-US/SharingAndReleasing/index.html?versions=4_26). *docs.unrealengine.com*. Retrieved April 22, 2021.

95. Kumparak, Greg (April 3, 2014). "Unreal Engine 4 Gets Support For Making Linux And SteamOS Games" (https://techcrunch.com/2014/04/03/unreal-engine-4-gets-support-for-making-linux-games/). *TechCrunch*. Archived (https://web.archive.org/web/20170810155811/https://techcrunch.com/2014/04/03/unreal-engine-4-gets-support-for-making-linux-games/) from the original on August 10, 2017. Retrieved August 10, 2017.

96. Cifaldi, Frank (March 29, 2013). "Interview: Epic goes all-in on HTML5 with UE4 support" (http://www.gamasutra.com/view/news/189583/Interview_Epic_goes_allin_on_HTML5_with_UE4_support.php). *Gamasutra*. Archived (https://web.archive.org/web/20170810171622/http://www.gamasutra.com/view/news/189583/Interview_Epic_goes_allin_on_HTML5_with_UE4_support.php) from the original on August 10, 2017. Retrieved August 10, 2017.

97. Skrebels, Joe (October 16, 2016). "Nintendo Switch Will Support Unreal Engine 4" (http://www.ign.com/articles/2016/10/21/nintendo-switch-will-support-unreal-engine-4). *IGN*. Archived (https://web.archive.org/web/20170801042012/http://www.ign.com/articles/2016/10/21/nintendo-switch-will-support-unreal-engine-4) from the original on August 1, 2017. Retrieved August 10, 2017.

98. Connors, Devin (April 24, 2014). "Epic Adds Xbox One, PlayStation 4 Support to Unreal Engine 4.1" (http://www.escapistmagazine.com/news/view/133982-Epic-Adds-Xbox-One-PlayStation-4-Support-to-Unreal-Engine-4-1). *The Escapist*. Archived (https://web.archive.org/web/20170810160803/http://www.escapistmagazine.com/news/view/133982-Epic-Adds-Xbox-One-PlayStation-4-Support-to-Unreal-Engine-4-1) from the original on August 10, 2017. Retrieved August 10, 2017.

99. "Unreal Engine 4.25 released!" (https://www.unrealengine.com/en-US/blog/unreal-engine-4-25-released). *Unreal Engine*. Retrieved May 6, 2020.

100. "Unreal Engine Support for Google Stadia Now Available" (https://www.unrealengine.com/en-US/blog/unreal-engine-support-for-google-stadia-now-available). Archived (https://web.archive.org/web/20200203002450/https://www.unrealengine.com/en-US/blog/unreal-engine-support-for-google-stadia-now-available) from the original on February 3, 2020. Retrieved February 3, 2020.

101. Koolonavich, Nikholai (March 19, 2018). "Magic Leap Release Developer SDK, Unreal Engine 4 Support Announced" (https://www.vrfocus.com/2018/03/magic-leap-release-developer-sdk-unreal-engine-4-support-announced/). *VRFocus*. Archived (https://web.archive.org/web/20180319192931/https://www.vrfocus.com/2018/03/magic-leap-release-developer-sdk-unreal-engine-4-support-announced/) from the original on March 19, 2018. Retrieved March 19, 2018.

102. Kastrenakes, Jacob; Robertson, Adi (April 30, 2015). "Steam's virtual reality just got a boost from the maker of Unreal Tournament" (https://www.theverge.com/2015/4/30/8519631/unreal-engine-4-steamvr-vive-support). *The Verge*. Archived (https://web.archive.org/web/20170810164836/https://www.theverge.com/2015/4/30/8519631/unreal-engine-4-steamvr-vive-support) from the original on August 10, 2017. Retrieved August 10, 2017.

103. Sykes, Tom (June 9, 2013). "Unreal Engine 4 gets Oculus Rift support, could spell good things for future indie games" (http://www.pcgamer.com/unreal-engine-4-gets-oculus-rift-support-could-spell-good-things-for-future-indie-games/). *PC Gamer*. Archived (https://web.archive.org/web/20170810165737/http://www.pcgamer.com/unreal-engine-4-gets-oculus-rift-support-could-spell-good-things-for-future-indie-games/) from the original on August 10, 2017. Retrieved August 10, 2017.

104. Feltham, Jamie (June 5, 2014). "Unreal Engine 4.2 Update Adds Project Morpheus Support On PS4 & PC" (https://www.vrfocus.com/2014/06/unreal-engine-4-2-update-adds-project-morpheus-support-ps4-pc/). *VRFocus*. Archived (https://web.archive.org/web/20170810170639/https://www.vrfocus.com/2014/06/unreal-engine-4-2-update-adds-project-morpheus-support-ps4-pc/) from the original on August 10, 2017. Retrieved August 10, 2017.

105. Matney, Lucas (March 15, 2016). "Native OSVR support comes to Unreal game engine" (https://techcrunch.com/2016/03/15/native-osvr-support-comes-to-unreal-game-engine/). *TechCrunch*. Archived (https://web.archive.org/web/20170810162724/https://techcrunch.com/2016/03/15/native-osvr-support-comes-to-unreal-game-engine/) from the original on August 10, 2017. Retrieved August 10, 2017.

106. Lang, Ben (September 16, 2014). "Samsung Gear VR and Google Project Tango Support Coming to Unreal Engine 4" (https://www.roadtovr.com/samsung-gear-vr-project-tango-ue4/). *Road To VR*. Archived (https://web.archive.org/web/20170810163524/https://www.roadtovr.com/samsung-gear-vr-project-tango-ue4/) from the original on August 10, 2017. Retrieved August 10, 2017.

107. Ryan, Vance (May 31, 2019). "Unreal Engine 4 support for HoloLens 2 released in early access" (https://www.unrealengine.com/en-US/blog/unreal-engine-4-support-for-hololens-2-released-in-early-access). *Unreal Engine*. Archived (https://web.archive.org/web/20191015235050/https://www.unrealengine.com/en-US/blog/unreal-engine-4-support-for-hololens-2-released-in-early-access) from the original on October 15, 2019. Retrieved June 11, 2019.

108. Graft, Kris (May 19, 2016). "Google's new VR headset gets Unreal Engine 4 support" (http://www.gamasutra.com/view/news/273018/Googles_new_VR_headset_gets_Unreal_Engine_4_support.php). *Gamasutra*. Archived (https://web.archive.org/web/20170810162414/http://www.gamasutra.com/view/news/273018/Googles_new_VR_headset_gets_Unreal_Engine_4_support.php) from the original on August 10, 2017. Retrieved August 10, 2017.

109. Statt, Nick (May 13, 2020). "Epic Games announces Unreal Engine 5 with stunning PlayStation 5 demo" (https://www.theverge.com/2020/5/13/21256079/epic-unreal-engine-5-playstation-5-demo-next-gen-graphics-release-date). *The Verge*. Retrieved December 11, 2020.

110. Takahashi, Dean (May 13, 2020). "Epic Games: Unreal Engine 5 will bring a generational change to graphics" (https://venturebeat.com/2020/05/13/how-epic-games-is-tailoring-unreal-engine-5-to-make-next-gen-graphics-shine/). *Venture Beat*. Retrieved May 13, 2020.

111. Makuch, Eddie (May 26, 2021). "Unreal Engine 5 Gets Stunning Demo With Incredible Graphics, Enters Early Access" (https://www.gamespot.com/articles/unreal-engine-5-gets-stunning-demo-with-incredible-graphics-enters-early-access/1100-6491998/). *GameSpot*. Retrieved May 26, 2021.

112. Valentine, Rebekah (May 13, 2020). "Epic Games announces Unreal Engine 5 with first PS5 footage" (https://www.gamesindustry.biz/articles/2020-05-13-epic-games-announces-unreal-engine-5-with-first-ps5-footage). *GamesIndustry.biz*. Retrieved May 13, 2020.

113. Tarantola, Andrew (May 13, 2020). "Epic Games teases its new, nearly-photorealistic Unreal Engine 5" (https://www.engadget.com/epic-games-unreal-engine-5-demo-150044561.html). *Engadget*. Retrieved May 13, 2020.

114. Orland, Kyle (May 14, 2020). "How Epic got such amazing Unreal Engine 5 results on next-gen consoles" (https://arstechnica.com/gaming/2020/05/behind-the-scenes-of-that-incredible-unreal-engine-5-tech-demo/). *Ars Technica*. Retrieved May 14, 2020.

115. McWhertor, Michael (May 13, 2020). "Here's Unreal Engine 5 running on the PlayStation 5" (https://www.polygon.com/2020/5/13/21256621/unreal-engine-5-ps5-demo-playstation-5-graphics-epic-games). *Polygon*. Retrieved May 13, 2020.

116. Statt, Nick (May 13, 2020). "Epic CEO Tim Sweeney says the PS5 is so impressive it's 'going to help drive future PCs' " (https://www.theverge.com/21256299/epic-ceo-tim-sweeney-sony-ps5-ssd-impressive-pc-gaming-future-next-gen). *The Verge*. Retrieved May 13, 2020.

117. Takahashi, Dean (May 13, 2020). "Epic Games shows off a stunning Unreal Engine 5 demo on PlayStation 5" (https://venturebeat.com/2020/05/13/epic-games-shows-off-a-stunning-unreal-engine-5-demo-on-playstation-5/). *Venture Beat*. Retrieved May 13, 2020.

118. Maher, Cian (May 16, 2020). "Unreal Engine 5 will be "fully supported on both PS5 and Xbox Series X" " (https://www.vg247.com/2020/05/16/unreal-engine-5-ps5-xbox-series-x/). *VG247*. Retrieved May 16, 2020.

119. Bailey, Dustin (May 13, 2020). "Fortnite moves to Unreal Engine 5 next year" (https://www.pcgamesn.com/fortnite/unreal-engine-5). *PCGamesN*. Retrieved May 13, 2020.

120. Grubb, Jeff (June 10, 2020). "Ninja Theory is using Unreal Engine 5 for Senua's Saga: Hellblade II" (https://venturebeat.com/2020/06/10/ninja-theory-is-using-unreal-engine-5-for-senuas-saga-hellblade-ii/). *Venture Beat*. Retrieved June 10, 2020.

121. Kerr, Chris (February 10, 2021). "Epic Games' new MetaHuman Creator will let devs everywhere build high fidelity humans" (https://www.gamasutra.com/view/news/377303/Epic_Games_new_MetaHuman_Creator_will_let_devs_everywhere_build_high_fidelity_humans.php). *Gamasutra*. Retrieved February 10, 2021.

122. Takahashi, Dean (March 30, 2021). "Epic Games teams up with Cesium to bring 3D geospatial data to Unreal" (https://venturebeat.com/2021/03/30/epic-games-teams-up-with-cesium-to-bring-3d-geospatial-data-to-unreal/). *Venture Beat*. Retrieved March 30, 2021.

123. Kerr, Chris (March 9, 2021). "Epic Games acquires photogrammetry software developer Capturing Reality" (https://www.gamasutra.com/view/news/378272/Epic_Games_acquires_photogrammetry_software_developer_Capturing_Reality.php). *Gamasutra*. Retrieved March 9, 2021.

124. Francis, Bryant (January 7, 2021). "Epic acquires RAD Game Tools" (https://www.gamasutra.com/view/news/375979/Epic_acquires_RAD_Game_Tools.php). *Gamasutra*. Archived (https://web.archive.org/web/20210107203724/https://gamasutra.com/view/news/375979/Epic_acquires_RAD_Game_Tools.php) from the original on January 7, 2021. Retrieved January 7, 2021.

125. Machkovech, Sam (May 13, 2020). "Unreal Engine is now royalty-free until a game makes a whopping $1 million" (https://arstechnica.com/gaming/2020/05/unreal-engine-is-now-royalty-free-until-a-game-makes-a-whopping-1-mill/). *Ars Technica*. Retrieved May 13, 2020.

126. "UDN - Three - UnrealScriptReference" (http://udn.epicgames.com/Three/UnrealScriptReference.html#Design%20goals%20of%20_UnrealScript). Udn.epicgames.com. Archived (https://web.archive.org/web/20130703145732/http://udn.epicgames.com/Three/UnrealScriptReference.html) from the original on July 3, 2013. Retrieved June 26, 2013.

127. Schultz, Warren. "Unreal Engine 4 - First Look" (https://web.archive.org/web/201205240629 35/http://gameindustry.about.com/od/trends/a/Unreal-Engine-4-First-Look.htm). *About.com*. Archived from the original (http://gameindustry.about.com/od/trends/a/Unreal-Engine-4-First-Look.htm) on May 24, 2012. Retrieved December 29, 2017.

128. Wawro, Alex (March 1, 2017). "For Tim Sweeney, advancing Epic means racing into AR and VR" (http://www.gamasutra.com/view/news/292573/For_Tim_Sweeney_advancing_Epic_m eans_racing_into_AR_and_VR.php). *Gamasutra*. Archived (https://web.archive.org/web/201 70720205027/http://www.gamasutra.com/view/news/292573/For_Tim_Sweeney_advancing _Epic_means_racing_into_AR_and_VR.php) from the original on July 20, 2017. Retrieved July 19, 2017.

129. Brown, Fraser (September 4, 2014). "The Unreal Engine Marketplace is open for business" (https://www.pcgamesn.com/unreal-engine-marketplace-open-business). *PCGamesN*. Archived (https://web.archive.org/web/20180713011518/https://www.pcgamesn.com/unreal-engine-marketplace-open-business) from the original on July 13, 2018. Retrieved July 12, 2018.

130. Chalk, Andy (July 12, 2018). "Fortnite is making so much money that Epic is giving Unreal Marketplace creators a big raise" (https://www.pcgamer.com/fortnite-is-making-so-much-mon ey-that-epic-is-giving-unreal-marketplace-creators-a-big-raise/). *PC Gamer*. Archived (https:// web.archive.org/web/20180713013236/https://www.pcgamer.com/fortnite-is-making-so-muc h-money-that-epic-is-giving-unreal-marketplace-creators-a-big-raise/) from the original on July 13, 2018. Retrieved July 12, 2018.

131. Bradshaw, Tim; Kruppa, Miles (August 12, 2020). "Epic and Unity rev their engines for the next era of entertainment" (https://archive.today/20200812195345/https://www.ft.com/conten t/f77b7979-c943-4b9d-b7b7-7953b63bea7e). Financial Times. Archived from the original (htt ps://www.ft.com/content/f77b7979-c943-4b9d-b7b7-7953b63bea7e) on August 12, 2020.

132. "Epic and Unity rev their engines for the next era of entertainment" (https://arstechnica.com/g aming/2020/08/epic-and-unity-rev-their-engines-for-the-next-era-of-entertainment/). *Ars Technica*. August 13, 2020.

133. "What is the best game engine: is Unreal Engine right for you?" (https://www.gamesindustry. biz/articles/2020-01-16-what-is-the-best-game-engine-is-unreal-engine-4-the-right-game-en gine-for-you). *GamesIndustry.biz*. Retrieved July 19, 2021.

134. Grubb, Jeff (November 19, 2019). "Why 'The Mandalorian' cites Fortnite dev Epic Games in its credits" (https://venturebeat.com/2019/11/19/why-the-mandalorian-cites-fortnite-dev-epic-games-in-its-credits/). *Venture Beat*. Retrieved August 1, 2020.

135. Desowitz, Bill (February 20, 2020). " 'The Mandalorian': How ILM's Innovative StageCraft Tech Created a 'Star Wars' Virtual Universe" (https://www.yahoo.com/entertainment/mandalo rian-ilm-innovative-stagecraft-tech-220120449.html). *Yahoo News*. Retrieved August 1, 2020.

136. Good, Owen (February 20, 2020). "How Lucasfilm used Unreal Engine to make The Mandalorian" (https://www.polygon.com/tv/2020/2/20/21146152/the-mandalorian-making-of-video-unreal-engine-projection-screen). *Polygon*. Retrieved August 1, 2020.

137. Vary, Adam (March 12, 2020). " 'Westworld' Showrunners on the Series' Bold New Direction for Season 3" (https://variety.com/2020/tv/features/westworld-season-3-hbo-lisa-joy-jonathan -nolan-1203529268/). *Variety*. Retrieved August 1, 2020.

138. Failes, Ian (June 25, 2020). " 'Westworld's' journey into the LED screen revolution" (https://b eforesandafters.com/2020/06/25/westworlds-journey-into-the-led-screen-revolution/). *Befores & Afters*. Retrieved November 17, 2020.

139. Hopewell, John (June 3, 2020). " 'Mandalorian'-Style Virtual Technology Sound Stage Orca Studios Opens in Spain" (https://variety.com/2020/tv/global/mandalorian-style-led-volume-or ca-studios-opens-spain-1234624036/). *Variety*. Retrieved August 1, 2020.

140. Wiseman, Andreas (January 21, 2021). " 'Fortnite' Creator Epic Games Makes Foray Into Movies With Animated Pic 'Gilgamesh' " (https://deadline.com/2021/01/fortnite-creator-epic-g ames-animated-movie-gilgamesh-1234676907/). *Deadline Hollywood*. Retrieved January 21, 2021.

141. Takahashi, Dean (April 26, 2021). "Spire Animation Studios kicks off Epic Games' new Unreal Shorts animated film program" (https://venturebeat.com/2021/04/26/spire-animation-s tudios-kicks-off-epic-games-new-unreal-shorts-animated-film-program/). *Venture Beat*. Retrieved April 26, 2021.

142. Yee, Erica (December 14, 2018). "The real reason Epic landed a $15 billion valuation is not Fortnite's viral video game success" (https://www.cnbc.com/2018/12/14/the-reason-epic-land ed-a-15-billion-valuation-is-not-fortnite-success.html). *CNBC*. Retrieved July 19, 2021.

143. Bell, Elliot (August 14, 2020). "Daily Crunch: Apple removes Fortnite from the App Store" (htt ps://theappdevelopers.co.uk/portfolio/daily-crunch-apple-removes-fortnite-from-the-app-stor e/). Retrieved August 14, 2020.

144. Statt, Nick; Peters, Jay (October 9, 2020). "Epic judge permanently restrains Apple from blocking Unreal Engine, but won't force Fortnite" (https://www.theverge.com/2020/10/9/2149 2334/epic-fortnite-apple-lawsuit-restraining-order-unreal-engine). *The Verge*. Retrieved October 9, 2020.

145. Cowley, Dana (November 15, 2018). "Unreal Engine Wins Technology & Engineering Emmy® for Animation Production" (https://www.unrealengine.com/en-US/blog/unreal-engin e-wins-technical-and-engineering-emmy-for-animation-production). *Unreal Engine*. Archived (https://web.archive.org/web/20181117022252/https://www.unrealengine.com/en-US/blog/u nreal-engine-wins-technical-and-engineering-emmy-for-animation-production) from the original on November 17, 2018. Retrieved November 16, 2018.

146. "Engineering Emmy Winners Announced" (https://www.emmys.com/news/awards-news/eng ineering-201008). *Emmys.com*. October 8, 2020. Retrieved October 10, 2020.

147. Davenport, Chris. "Epic Games' Unreal Engine Will be Recognized at Annie Awards" (http s://gamerant.com/epic-games-unreal-enginge-annie-awards/). *Gamerant*. Retrieved March 7, 2021.

148. "GDM January 2005" (https://archive.org/stream/GDM_January_2005#page/n0/mode/2up). *Game Developer Magazine*. CMP United Business Media. January 2005. Archived (https://w eb.archive.org/web/20191016081726/https://archive.org/stream/GDM_January_2005#page/ n0/mode/2up) from the original on October 16, 2019. Retrieved July 15, 2016.

149. "GDM January 2006" (https://archive.org/stream/GDM_January_2006#page/n0/mode/2up). *Game Developer Magazine*. CMP United Business Media. January 2006. Retrieved July 15, 2016.

150. "GDM January 2007" (https://archive.org/stream/GDM_January_2007#page/n0/mode/2up). *Game Developer Magazine*. CMP United Business Media. January 2007. Retrieved July 15, 2016.

151. "GDM January 2008" (https://archive.org/stream/GDM_January_2008#page/n0/mode/2up). *Game Developer Magazine*. CMP United Business Media. January 2008. Retrieved July 15, 2016.

152. "GDM January 2010" (https://archive.org/stream/GDM_January_2010#page/n0/mode/2up). *Game Developer Magazine*. CMP United Business Media. January 2010. Archived (https://w eb.archive.org/web/20191016081821/https://archive.org/stream/GDM_January_2010#page/ n0/mode/2up) from the original on October 16, 2019. Retrieved July 15, 2016.

153. "GDM January 2011" (https://archive.org/stream/GDM_January_2011#page/n0/mode/2up). *Game Developer Magazine*. UBM plc. January 2011. Retrieved July 15, 2016.

154. "GDM January 2012" (https://archive.org/stream/GDM_January_2012#page/n0/mode/2up). *Game Developer Magazine*. UBM plc. January 2012. Retrieved July 15, 2016.

155. "GDM January 2013" (https://archive.org/stream/GDM_January_2013#page/n0/mode/2up). *Game Developer Magazine*. UBM plc. January 2013. Retrieved July 15, 2016.

156. French, Michael (July 16, 2009). "Develop Awards: The Winners In Full" (http://www.develop-online.net/news/develop-awards-the-winners-in-full/0105040). *Develop*. Archived (https://web.archive.org/web/20160722040622/http://www.develop-online.net/news/develop-awards-the-winners-in-full/0105040) from the original on July 22, 2016. Retrieved July 15, 2016.

157. Crossley, Rob (July 15, 2010). "Develop Awards: Unreal Engine wins tight race" (http://www.develop-online.net/news/develop-awards-unreal-engine-wins-tight-race/0107364). *Develop*. Archived (https://web.archive.org/web/20160722040056/http://www.develop-online.net/news/develop-awards-unreal-engine-wins-tight-race/0107364) from the original on July 22, 2016. Retrieved July 15, 2016.

158. Hoggins, Tom (July 21, 2011). "Develop Industry Excellence Award winners announced" (https://www.telegraph.co.uk/technology/video-games/8652100/Develop-Industry-Excellence-Award-winners-announced.html). *The Daily Telegraph*. Archived (https://web.archive.org/web/20160722040525/http://www.telegraph.co.uk/technology/video-games/8652100/Develop-Industry-Excellence-Award-winners-announced.html) from the original on July 22, 2016. Retrieved July 15, 2016.

159. French, Michael (July 10, 2013). "Game development stars honoured in Brighton" (http://www.develop-online.net/news/game-development-stars-honoured-in-brighton/0115352). *Develop*. Archived (https://web.archive.org/web/20160722040500/http://www.develop-online.net/news/game-development-stars-honoured-in-brighton/0115352) from the original on July 22, 2016. Retrieved July 15, 2016.

160. Kayser, Daniel (July 14, 2016). "Unreal Engine 4 Wins Develop Industry Excellence Award for Best Engine" (https://web.archive.org/web/20160722040420/https://www.unrealengine.com/news/unreal-engine-4-wins-develop-industry-excellence-award-for-best-engine). *Unreal Engine*. Epic Games. Archived from the original (https://www.unrealengine.com/news/unreal-engine-4-wins-develop-industry-excellence-award-for-best-engine) on July 22, 2016. Retrieved July 15, 2016.

161. Cowley, Dana (July 25, 2017). "Develop Industry Excellence Awards 2017: Best Engine" (https://www.unrealengine.com/en-US/blog/develop-industry-excellence-awards-2017-best-engine). *Unreal Engine*. Archived (https://web.archive.org/web/20170805195851/https://www.unrealengine.com/en-US/blog/develop-industry-excellence-awards-2017-best-engine) from the original on August 5, 2017. Retrieved July 26, 2017.

162. Barton, Seth (July 12, 2018). "The Develop Awards 2018: All the winners!" (https://www.mcvuk.com/development/the-develop-awards-2018-all-the-winners). *MCV*. Retrieved July 18, 2018.

163. "Most successful videogame engine" (http://www.guinnessworldrecords.com/world-records/most-successful-game-engine). Guinness World Records. Archived (https://web.archive.org/web/20151222151655/http://www.guinnessworldrecords.com/world-records/most-successful-game-engine) from the original on December 22, 2015.

Further reading

- Kosak, Dave. "Talking with Tim Sweeney about the evolution of a game engine" (https://web.archive.org/web/20010621202712/http://www.gamespy.com/legacy/interviews/sweeney_a.shtm). *GameSpy*. Archived from the original (http://www.gamespy.com:80/legacy/interviews/sweeney_a.shtm) on June 21, 2001. Retrieved June 21, 2001.

- Buecheler, Christopher. "Tim Sweeney discusses the Unreal Engine" (https://web.archive.org/web/20010621195145/http://www.gamespy.com/legacy/articles/engineweek2_a.shtm). *GameSpy*. Archived from the original (http://www.gamespy.com:80/legacy/articles/engineweek2_a.shtm) on June 21, 2001. Retrieved June 21, 2001.

- Keighley, Geoffrey. "Blinded By Reality: The True Story Behind the Creation of Unreal" (https://web.archive.org/web/2001 0519154729/http://www.gamespot.com/fea tures/makeunreal/). *GameSpot*. Archived from the original (http://www.gamespot.co m/features/makeunreal/) on May 19, 2001.
- Herz, J.C (December 1999). "GAME THEORY; For Game Maker, There's Gold in the Code" (https://www.nytimes.com/199 9/12/02/technology/game-theory-for-game-maker-there-s-gold-in-the-code.html). *The New York Times*.
- Thomsen, Mike (February 2010). "History of the Unreal Engine" (http://www.ign.com/ articles/2010/02/23/history-of-the-unreal-en gine). *IGN*.
- Gaudiosi, John (September 2011). "Epic Games Founder Tim Sweeney Pushes Unreal Engine 3 Technology Forward" (htt ps://www.forbes.com/sites/johngaudiosi/20 11/09/21/epic-games-founder-tim-sweeney -pushes-unreal-engine-3-technology-forwa rd/). *Forbes*.
- Bullis, Kevin (November 2011). "Epic Games Finds New Customers" (https://ww w.technologyreview.com/s/426071/epic-ga mes-finds-new-customers/). *MIT Technology Review*.
- Horvath, Stu (May 2012). "The Imagination Engine: Why Next-Gen Videogames Will Rock Your World" (https://www.wired.com/ 2012/05/ff_unreal4/all/). *Wired*.
- Totilo, Stephen (June 2012). "How Unreal Engine 4 Will Change The Next Games You Play" (https://kotaku.com/5916859/ho w-unreal-engine-4-will-change-the-next-ga mes-you-play). *Kotaku*.
- Thier, Dave (June 2012). "Epic's Tim Sweeney on How Unreal Engine 4 Will Change The Way Games Are Made, and Why You Care" (https://www.forbes.com/sit es/davidthier/2012/06/29/epics-tim-sweene y-on-how-unreal-engine-4-will-change-the-way-games-are-made-and-why-you-care/). *Forbes*.
- Steiner, Brian (June 2013). "How The Unreal Engine Became A Real Gaming Powerhouse" (http://www.popularmechani cs.com/culture/gaming/a9178/how-the-unr eal-engine-became-a-real-gaming-powerh ouse-15625586/). *Popular Mechanics*.
- Plante, Chris (March 2015). "Why video game engines may power the future of film and architecture" (https://www.theverge.co m/2015/3/4/8150057/unreal-engine-4-epic-games-tim-sweeney-gdc-2015). *The Verge*.
- Harrington, Richard (November 2016). "The game is on: automotive product development in a new virtual world" (http s://www.automotiveworld.com/analysis/ga me-automotive-product-development-new-virtual-world/). *Automotive World*.
- Wawro, Alex (March 2017). "For Tim Sweeney, advancing Epic means racing into AR and VR" (https://www.gamasutra.c om/view/news/292573/For_Tim_Sweeney _advancing_Epic_means_racing_into_AR _and_VR.php). *Gamasutra*.
- Gaudiosi, John (March 2017). "Epic Games' Unreal Engine Is Opening Enterprise Business Doors In Automotive, And Other Industries" (http://www.alistdaily. com/strategy/epic-games-unreal-engine-is-opening-enterprise-business-doors-in-auto motive-and-other-industries/?nabt=1). *[a]listdaily*.
- Batchelor, James (April 2017). "Sweeney: "The future of the games industry? Make everyone a creator" " (http://www.gamesind ustry.biz/articles/2017-04-13-sweeney-the-f uture-of-the-games-industry-make-everyon e-a-creator). *GamesIndustry.biz*.
- Leif, Johnson (November 2017). "How Unreal Tournament mods created a wave of successful indie studios" (https://www.pc gamer.com/how-unreal-tournament-mods-c reated-a-wave-of-successful-indie-studio s/). *PC Gamer*.
- Lightbown, David (January 2018). "Classic Tools Retrospective: Tim Sweeney on the first version of the Unreal Editor" (https://w ww.gamasutra.com/blogs/DavidLightbown/ 20180109/309414/Classic_Tools_Retrosp ective_Tim_Sweeney_on_the_first_versio n_of_the_Unreal_Editor.php). *Gamasutra*.
- Yee, Erica (December 2018). "The real reason Epic landed a $15 billion valuation is not Fortnite's viral video game success" (https://www.cnbc.com/2018/12/14/the-reas on-epic-landed-a-15-billion-valuation-is-no t-fortnite-success.html). *CNBC*.

- Alba, Michael (March 2020). "Unreal Engineering: How a Game Engine is Playing in New Industries" (https://www.engineering.com/DesignSoftware/DesignSoftwareArticles/ArticleID/19974/Unreal-Engineering-How-a-Game-Engine-is-Playing-in-New-Industries.aspx). *Engineering.com.*

External links

- Official website (https://www.unrealengine.com) 🖉