

A live comparison between Unity and Unreal game engines

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Abstract

A game engine is an ongoing thread that helps us in making and designing beautiful games with the simplest methods and least resources. Game engines support a wide variety of playing platforms that can translate the game designed into a playable game in different platforms like PlayStation, PC, Xbox, Android, IOS and Nintendo. There is a wide variety of game engines that suits every programmer and designer working on engines such as Unity game engine, Unreal game engine and construct game engine. In order to make a game one has to learn how to code in one of these engines. From our results, Unity has everything you need to create games in one place. It has an integrated development framework that creates rich solutions and out-of-box functionality to make games. This paper recommends making a decision one has to look at, such as what platforms one wants to target and how one can plan on monetising their product.

Keywords: Game engine, compare engine, Unity game, Unreal game, platforms.

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1. Introduction

A game engine is a tricky thing to define, the term is often thrown around in the gaming community but not everyone really knows what one is. The reason for the confusion is because engines come in many forms, and the actual implementation of one would be lost on someone unfamiliar with software development. Let us preface a more in-depth description by talking about how a computer works. A computer at the ground floor is a series of physical circuits either on or off, and on top of that the values string together into commands eventually forming an operating system; the operating system can then create applications based on higher level programming languages, and these languages can then be used to operate game engines and web browsers. As we can see 'computers work on a principle which can be described as layers of abstracted complexity' (Michaelenger).

Game engines lie on top of the stack of complexity described, and so the Wikipedia definition seems somewhat appropriate: '...a software framework designed for the creation and development of making video games'. A game engine takes common tasks of coding that are generally involved in game development and provides them in an accessible library. This allows developers to create their games without having to build everything from the ground up. With all that being said, the idea of a game engine still seems a bit muddy and abstract, so we will try to provide an analogy. All cars need an engine to function and drive the vehicle forward, and if you were to develop a new type of car it could be advantageous to buy a prebuilt engine rather than putting the pistons, cylinders and other parts together from scratch; then the team could spend more time on the body, paint, stereo system etc. All games use components that would compare to a car engine: animations, loading, displaying, user input, collisions, physics etc. With an engine in place, developers can spend more time on the parts of the game that make it unique like graphics, gameplay, characters, levels and more.

2. Methods and materials

This research is an overview study in which the final result is a wide view on comparing the Unity game engine and the Unreal game engine.

3. Data collection and analysis

3.1. Unity game engine

3.1.1. Overview

The Unity game engine is a multi-functionality game engine that can support 2D and 3D graphics along with drag and drop and the benefit of C# scripting. There were two additional scripting languages like Boo which were deleted when they released Unity 5 and JavaScript which began the removal process in the beginning of Unity 2017. Unity supports the following APIs: Direct3D on Windows and Xbox One; OpenGL on Linux, MacOS and Windows; OpenGL ES on Android and iOS; WebGL on the web; and professional APIs on video game consoles. In addition, Unity provides many other APIs.

Unity allows in 2D games importing outside animated patterns along with the advanced 2D world viewer. As for 3D games, Unity can compress textures and mipmaps along with other different graphical settings that suit every platform it supports. It supports terrain design, reflection mapping, landscape layout and SSAO, which stands for screen space ambient occlusion. Unity also provides developer services: Unity ads, Unity analytics, Unity certification, Unity cloud build, Unity every play, Unity IAP, Unity multiplayer, Unity performance and reporting and Unity collaborate. It can create a custom vertex, part (or pixel), tessellation, compute shaders and shading Unity's own surface using Cg which is a modified version of Microsoft's high-level shading language.

3.1.2. Supported platforms

Unity can module into 27 different platforms, some of them are IOS, Android, Vulkan, Oculus Rift, Windows, Linux, Mac OS, Samsung TV, PlayStation 4, PlayStation Vita, VR Rift, Android TV, Facebook Game room etc.

Unity has previously supported seven other platforms, including its Unity Web Player software, which was turned off for WebGL.

Unity is the primary SDK for the Wii U console platform, with a free version by Nintendo with each Wii U developer license. Unity calls this package of third-party SDK an 'Industry First'.

3.1.3. History

In 2012, VentureBeat said: 'Few companies have contributed significantly to the flow of independently produced games called Unity Technologies. ... More than 1.3 million developers are using its tools to create gee whiz graphics on iOS, Android, console, PC, And web games ... Unity wantsto be the engine for multi-platform games, period'. For the Apple Design Awards at the WWDC 2006, Apple, Inc. named Unity as the second best-used category for Mac OS X Graphics; 1 year later, Unity launched at the same trade show. Unity Technologies says this is the first time a game design tool has been nominated for this award. A May 2012 Game Developer poll identified Unity as the best gaming engine for mobile platforms. In July 2014, Unity won the 'Best Engine' award at the annual UK's Develop Industry Excellence Awards.

Unity 5 received similar praise, with The Verge saying that 'Unity has begun with the aim of making the development of games available to all. Unity 5 is a long-awaited step towards the future'. After Unity 5 was released, Unity Technologies received some criticism for the huge production of fast- produced games released on the Steam platform by inexperienced developers. CEO John Riccitiello said in an interview that he thought this would be one of the side effects of democratising game development: 'If I had my way, I would like to see 50 million people using Unity - although I do not think we will get there any time soon I'd like to see high school and college kids using it, people outside the core industry. I think it's sad that most people are consumers of technology and not creators. The world's a better place when people know how to create, not just consume, and that's what we're trying to promote'. He said in December 2016, Unity Technologies announced that they will change Unity's version numbering system from sequence-based identifiers to release year to align its versions with its most frequent launch.

3.1.4. Marketing

On December 16, 2013, Unity Technologies Japan unveiled new screenshots of an official mascot named Unity-Chan (Yuniti-chan), real name Kohaku Otori (expressed by Asuka Kakumoto), with a character show at Tokyo's Comic Market 85 event from 29 to 31 December, where goods of the special character were distributed and her voice actress was represented at the event. The game data associated with the character were to be released in the spring of 2014. The character was designed by the Japanese designer of Unity Technologies 'ntny' as an open-source heroine. The company allows the use of Unity-Chan and associated characters in secondary projects under certain licenses. For example, Unity-Chan appears as a playable character in Run bow. The popularity of the character also resulted in VOCALOID adaptations appearances, including its own VOCALOID 4 audio library and a special VOCALOID configuration designed to work with Unity Engine 5.0 named Unity with VOCALOID.

3.2. Unreal game engine

The Unreal Engine was developed by Epic Games Inc.; the first game had been made by the engine called Unreal. Its main use was for FPS games only, but it proved useful in other game genres like MMORPG, Stealth, Adventure etc. The source code is written in C++ and the most advantageous feature is its portability and it is being used by a lot of game developers nowadays. The game engine has a lot of awards and one of them is the Guinness World Record for the most successful game

engine. The official stable version is Unreal Engine 4. It can support Windows, Mac OS, Oculus Rift, Xbox, PS, Nintendo and other platforms that are crucial in the gaming industry nowadays.

3.2.1. History

Unreal Engine 1

The first generation of the Unreal game engine was made by Epic Game Inc. founder Tim Sweeney; the game engine was inspired from Carmack's marvellous work on Doom and Quake. The game engine started in 1995 and the developer started developing a FPS game called Unreal which was released 3 years later in 1998 and it is a medieval game with alien weapons and elements. In the first edition of the game engine, it has both software and hardware rendering along with collision detection, coloured lights, texture filtering and a level editor called Unreal Ed which had real-time geometry operations and was supported in the beginning of 1996. In the development process, they added real-time detection illumination and light sourcing which were integrated, respectively, in 1995 and 1997. Unreal had the support for Windows, Mac and Linux. It started the support of PlayStation 2 in the opening of Unreal tournament; along with a secret level, they supported Dreamcast also. Unreal added a lot of improvements in 2000 like the skeletal animation system, higher polygon models and large-scale terrain system. In the end of 1999, New York Times announced that 16 projects were using Unreal game engine like Deus Ex, Nerf Blast Arena and Duke Nukem Forever, which were made by 3D Realms and it was extraordinary famous on GameCube Consoles. It costed around 3 million dollars to create and 350 thousand dollars to license. Unreal gave creators the ability of creating their own world with the help of Unreal Ed and Unreal Script, which is a newly added scripting language.

Unreal Engine 2

In 2002, the second version of the Unreal game engine came out along with a game called America's Army, which was a free multiplayer shooter game developed by the U.S. Army for recruitment. This version was the same as last but the renderer was totally rewritten. It had a lot of varieties such as exporting plug-ins from Maya and 3D Max, Karma Physics Engine and Matinee Cinematic edition tool. It had a new version of Unreal Ed called Unreal Ed 2 which was distributed just before this generation came out and followed shortly by Unreal Ed 3. It had improved assets and added support to Xbox console Platform.

Unreal Engine 2.5 was the same as Unreal Engine 2, but they added a few features like vehicle physics, particle system editor for Unreal Ed and a 64-bit support, and they improved the overall rendering performance. Ubisoft Montreal announced that Unreal Engine 2 can module successfully to Nintendo 3DS in March 2011.

Unreal Engine 3

In 2004, there were screenshots of the UE3 which were under development for over 18 months, but unlike UE2 which had the support of fixed function pipeline, UE3 was developed to use the advantageous of the fully programmable hardware shader. All lightening calculations were made by pixel. UE3 supported gamma correct high dynamic range renderer.

Firstly, UE3 supported only Windows, PlayStation 3 and Xbox 360; IOS and Android were added in late 2010. Infinity Blade was the first game made for IOS and Dungeons Defenders was the first for Android. OS X support was added in 2011 along with the support of Adobe Flash Player 11 and it had been added through stage 3D hardware accelerated APIs. It was used in two Wii U games: Batman: Arkham City and Aliens: Colonial Marines. In 2012, Windows 8 and Windows RT support was added. Epic Games cooperated with Mozilla in 2013 to add the support of HTML5. UE3 added a lot of significant updates through its lifetime like large crowd simulations, destructible objects, touch functionality, soft body dynamics, iPod support, real-time global illumination solution, Steam works integration etc.

Unreal development kit

Although Unreal Engine 3 was just released for Modder's to work with, they need to buy a license to be able to publish and sell games. However, Epic Games released a free version of UE3's SDK in November 2009. It was called UDK which stands for the Unreal development kit. They added the support of both IOS and Android in December 2010.

Unreal Engine 4

Mark Rein, Vice President of Epic Games, announced that Unreal Engine 4 was under development since 2003 in August 2005. It was not until 2008 that the development was basically carried out by Tim Sweeny the CEO of Epic Games. The engine supports the eighth generation consoles, PCs and Tegra K1-based devices running Android that was announced in January 2014 at CES. UE4 has a major feature which is real-time global illumination using voxel cone tracing, pre-computed lighting was eliminated. Prior to release, this feature was replaced by a less computationally expensive algorithm for platforms support because of some performance concerns. UE4 has also included a new feature for reducing iteration time and update C++ code while the engine is running. The new visual scripting system allows the rapid development of game logic without the use of C++, and has the ability of live debugging.

At the game developers' conference on 19 March 2014, Epic Games released Unreal Engine 4 with all its tools and a complete C++ source code to the community, which was only available through a subscription model. Epic Games CEO said that the new engine is a reflection of the changes of the industry. Epic Games made its new engine available to huge AAA development teams but at the cost of millions of dollars because of the evolving of the gaming industry. On 4 September 2014, Epic Games made a release of the game engine to schools and universities for free, including a personal copy for students enrolled in game development courses, art, computer science, simulation, architecture and visualisation programmes.

On 19 February 2015, Epic Game launched Unreal Dev with a 5-million-dollar development fund that was made to provide financial aid to innovative projects made by UE4. After March 2015, UE4 had become available to everyone for free with all its future updates, but with a selective royalty schedule. On October 2016, Oculus Rift announced that it will cover all royalty fees of all UE4 titles shipped on Oculus Store for up to the first 5-million-dollar revenue per game. Currently supported platforms by UE4 are Mac OS, Windows, Linux, HTML5, IOS, Android, Steam OS, Nintendo Switch, PlayStation 4, Xbox one, Magic leap one and virtual reality.

3.3. Unreal Script

Unreal Script is UE's native scripting language being used for designing game code and gameplay events before UE4 release. It was made as a simple, high-level game programming language. Same as in Java, Unreal Script is object-oriented without multiple inheritance and classes are created in individual files named for the class they inherit from. Different from Java, Unreal Script has no object wrappers for primitive types. Interfaces were only supported in the third generation engine and few UE2 games. Unreal Script supports operator overloading, but not method overloading, except for optional parameters. At the 2012 Game Developers Conference, Epic announced that Unreal Script was being removed from Unreal Engine 4 in favour of C++. Visual scripting would be supported by the Blueprints Visual Scripting system.

3.3.1. Reception

3.3.1.1. Awards and nominations. The Unreal game engine won several technology awards, some of them are eight Game Developer Magazine Front Line Awards for best Game Engine. It has a place in the Front Line Awards Hall of Fame and six Develop Industry Excellence Awards for best engine. It also won Games Radar's E3 in 2012 important stuff awards for 'Best Taste of Next Gen', IGN's best of E3 2012 for 'Coolest Tech', Game Informer's best of E3 2012 awards for 'Best Tech' and was named 'Best

Engine' in Develop 100: The Tech List 2014. Guinness World Records named Unreal Engine as the most successful video game engine in 2014.

4. Results

Unity has everything one needs to create games in one place. It has an integrated development framework that creates rich solutions and out-of-box functionality to make games. One can assemble assets and art into environments and scenes, add audio, special effects, lighting and animations. Unity is also the most popular game engine in the world, with its 45% share of the market; it affects over 600 million gamers around the world.

4.1. Pros

- Unity can support 25 different platforms including: IOS, Android, Nintendo Switch, VR/AR etc.
- Powerful graphical engine that is optimised for many devices (consistent FPS across hundreds of devices).
- Supports JavaScript and C# codes.
- Drag and drop ability.
- Huge community of developers.
- Fair pricing.
- Huge asset store with prebuilt templates that are plug and play.
- 2D and 3D support.

4.2. Cons

- It is very complicated to learn the game engine.
- Overwhelming to new developers due to its complexities.
- Optimising graphically intensive games can be difficult (needs custom models etc.).
- Integrating mobile APIs, advertising etc. are more challenging than other engines.

Unreal Engine is one of the most popular game engines available today and is famous for first- person shooters, but is great for MMORPGs, RPGs, fighting and stealth games. Unreal Engine is a cross-platform game engine that supports a wide variety of platforms and one may have played a game made by Unreal Engine.

4.3. Pros

- Default version has a profiler.
- Its graphical capabilities are way out of the competition.
- Has good templates on its asset store.

4.4. Cons

- Uses C++ which requires more programming experience than C# or JavaScript.
- Epic Games (makers of Unreal) get 5% royalty on everything one earns.
- Limited third-party APIs compared to other engines.
- Builds are not optimised well for lower spec devices.

5. Conclusion

Ultimately, to make a decision one has to look at what platforms one wants to target and how one plan on monetising their product.

However, now that new consoles and devices are being made, Unity seems to be supporting almost every new product. This is a huge advantage since using Unity allows you to release on platforms that other engines do not support. Even though the hurdles to learn Unity are challenging, the reward is more than worth it.

Unreal Engine seems to be a better option for games needing graphically intensive performance and for companies that have very experienced development teams. However, for small companies looking to target multiple platforms and monetise effectively, Unity wins the battle.

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