Game Development with Unreal Engine 5

Learn the Basics of Game Development in Unreal Engine 5

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About the Authors

Cliff Sharif (aka Emperor Katax) is programmer and digital artist. His first touch to digital content was with Commodore 64 and Amiga 500. He practiced early steps of programming multimedia and real-time application with these platforms and also touched first edges of digital art belongs to that era. Then he began his carrier with programming and digital art in 1998, by using Windows 98.

Cliff was an Unreal Tournament pro gamer and was involved with WCG international tournaments as team organizer back in 2004. Then after publishing his first book “Unreal Engine Physics Essentials”, he switched his main carrier on develop application with Unreal Engine. He was involved in develop, manage and design industry standard applications of Virtual Reality, Architectural Visualizations, Real-time midi-controlled visuals, and recently Virtual Production by using Unreal Engine with Blueprint and C++. He certified as “Unreal Authorized Instructor – UAI” by Epic Games in 2020 and after that his main focus went for teaching game programming and design with Unreal Engine to students around the world.

Mitchell Lynn is a programmer who has been playing videogames since before he could walk, he started out playing classics like DOOM and Quake on his Grandfather’s old hardware, and has continued playing through every gaming generation since. This experience has been extremely helpful to his progression and capability as a programmer.

After completing secondary education, Mitch decided to enter into the industry of creating the games that had occupied so much of his life. After a couple of years studying under Cliff to become a competent programmer, he entered the industry working on Virtual Reality simulation software, and then started developing games, both of which using Unreal Engine. He specializes in data management-based programming, and is always happy to assist those interested in becoming a programmer themselves.

Preface

The Unreal Engine 5 is the latest game development engine released by Epic Games, and this book will cover the basic setup and usage of the engine, as well as provide and explain examples of how to create fundamental objects of a game.

After a quick review of mathematics used in game design, we go through Unreal Editor which is the main environment for debug and develop the application by using Unreal Engine 5. Then users will learn how to use programming skills in develop application by using unreal engine 5 templates and Blueprint visual programming language. This part will establish a base to discover and learn other parts of the engine in future chapters.

Users will learn create Actors which are fundamental game objects in the engine. Then we learn how to use data structures, im0plement event and event dispatchers, using interface, and handling users input data. We learn about shaders, Niagara particle system, Metasound and packaging the project by making practical examples with step-by-step instructions.

By the end of this book, user has an intermediate to advanced knowledge of how to use engine templates, and make standalone executable prototypes of games or interactive application using Unreal Engine 5.

Chapter 1 This chapter is for absolute beginners in game development. We learn about “Game Engine” and will focus on the Unreal Engine as an example of a popular and high-quality game engine which is the focus of this book. Then we go through the installation process and describe how to customize the engine based on the user requirements. Also, we will learn how to use the Epic Games Launcher which is basically an interface to access Epic Games applications, of which Unreal Engine 5 is the latest one.

Chapter 2 Game developers need proper math skills for solving complex problems. An example could be calculation movement of 3D object in space, or calculating a target angle between 2 objects when they are pointing towards the player. Solving each of these problems requires knowledge of math which we learn in this chapter. Covering each aspect of the mathematical approach used in the digital world is not our goal in this chapter, but the user will go through the basics of math and follow the learning path to permit understanding more complex topics.

Chapter 3 This chapter will cover using the Epic Games launcher to open, update, or repair the engine, as well as how to use the marketplace. It will also cover the basic standard layout of the editor, how to modify the layout of the editor, where the important menus are located, their purpose, and how to use them, as well as explain useful hotkeys (and Reroute nodes), and skim through the project settings and plugins menus.

Chapter 4 Unreal Engine 5 uses a visual scripting language for making games and applications known as “Blueprint”. In this chapter users will learn the basics of blueprints, how to make and populate them in the scene and learn how to import mesh components into the game application and assign them in the blueprint. Also, users will learn how to use game engine resources by adding blueprint components to their blueprint object and basics of using physics. At the end, users learned basic knowledge of blueprint design before they learn coding in blueprints in the next chapters.

Chapter 5 By using previous knowledges from chapter 4, users will learn how to develop code in blueprints and make game objects. Also, users will learn about Unreal Engine 5 templates, and how to program user input to the game character which meet learning more about Project Setting in the editor. Also, user learn how to change graphic setting of game in cases of rendering and light.

Chapter 6 Levels within UE5 consist of objects, (of which there are many types), and knowing these objects and how they function within the application, is essential for efficient & effective “Object Oriented” programming. We learn about game objects and materials in this chapter. Numbers of actor components that create game object in the game, can use materials. Material changes the appearance of the game object and can be simple or very complex.

Chapter 7 This chapter will cover the basic types of data (Ones that see regular use) used within Unreal Engine 5 (And programming in general), what each type is exactly, additional information about them, as well as their uses and benefits, with use-case examples. It will also cover how they can interact with each other (Pin splitting and conversions)

Chapter 8 Previously in chapter 5, users learned to use collision events to handle the collision. Now they will learn an advanced level of programming blueprints which is “Event Handling” and “Interface”. We learn the “core knowledge” of communication between game objects in the engine which is essential for any scenario of applications development with Unreal Engine 5.

Chapter 9 There are a number of more complicated types of variables that aren’t used as much as the simpler ones, but are arguably more important, as they are generally used for creating larger, core systems that the simpler variables are used within. We also cover how to use data for changing pos, in an animation Instance game object.

Chapter 10 This chapter will cover the more advanced aspects of game objects, including some other components with their functionalities/events (Projectile components, actor components, projectile components, movement components, etc.). It will also cover saving data to the system that game is running on, for future usage (Serialization), which is important for keeping track of player progress and their settings.

Chapter 11 In this chapter, users learn how to use the Unreal Engine 5 audio engine and develop audio code for the game. This feature is new in Unreal Engine 5 compare to previous versions of the engine. Also, users learn the basics of using Niagara which is a particle system simulator inside the engine to generate VFX effects. We explain a simple pipeline by a practical example, for using these features.

Chapter 12 Packaging a project is the last milestone of making any application by using Unreal Engine. There are numbers of options, with layers of details which are designed for packaging the application for different target machines. It basically takes time and research, to learn the best options for packaging your application, but we cover the main concept behind packaging and how the editor provides tools and resources on this. Also, users will learn how to avoid possible issues on packaging data.

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CHAPTER 1

What is Unreal Engine?

A long time ago, in order to make a video game, creative developers had to work hard and solve complex problems. They had to develop their own *Game Engine*, making assets, debug the application and release it with limited hardware variations in the market at that time. The *Game Engine* is an application for creating, debugging, and publishing a video game for target machines like PC, VR, mobile, and so on. After the release of Windows 95 by Microsoft, developers got standard framework and network tools for developing high-quality and multiplayer games, which led them to create more powerful game engines. At the same time, the game industry got massive support from hardware and software manufacturers, which not only increased audio and visual quality but also supported new gaming platforms and AR/VR gaming.

Today, a team of developers and designers with a creative mind have a number of game engines and massive resources from industry to begin their project. We will learn how to use *Unreal Engine 5*, which is one of the most successful game engines in the industry and has massive support from the community of game developers.

Structure

In this chapter, we will discuss the following topics:

- History of Unreal Engine
- Installing Epic Games Launcher

Objectives

After studying this chapter, you should be able to install Epic Game Launcher and Unreal Engine 5, and you should know how to customize your installation. In this chapter, we will also go through a brief history of Epic Games and Unreal Engine and review some important titles there.

History of Unreal Engine

Everything began back in the late ’80s with *Tim Sweeney* from Maryland, when he returned home from work for holiday and turned on his IBM computer to play a video game, like he did when he was younger. He soon noticed that he is passionate about making computer games as a career, but it was an unusual decision and risky at the time. The game industry was so poor in terms of hardware and software and more importantly, lack of technical resources for making games was a serious problem for developing video games; however, none of these problems changed his mind.

Tim is one of the pioneers of the game industry like *John Carmack* from Id software (as you can see in *Figure 1.1*), who developed their own game engine from the beginning of their career. At the very beginning, he learned how to develop applications by using object-oriented programming methods, and then he developed his first game, known as ZZT, released for MS-DOS by 1991. It was a puzzle game with the *modding* ability. After that, he entered the game industry by opening his own company, *Epic Game*.

Figure 1.1: *John Carmack and Tim Sweeney in GDCA 2017*

In 1998, Epic Games released their first video game in the **first-person shooter** (**FPS**) genre called *Unreal*, and it got a lot of attention due to the quality of visuals in game, skeleton mesh animations, rendering techniques, audio effects, and rich game story. For making *Unreal*, they developed their own game engine with an editor to debug code and design game objects. By 1999, Epic Games released *Unreal Tournament*, which was a multiplayer first person shooter (FPS) game, and it was developed with same engine as *Unreal* (refer to *Figure 1.2*):

Figure 1.2: *First series of FPS shooter games which released by Epic Games and developed by Unreal Engine*

After the millennium, Epic Games put a massive push on the quality and flexibility of their engine and, they worked on supporting multiple platforms by the engine. That led studios and game developers to making several big titles in the industry, like *Bioshock* and *Borderland*, which brought massive marketing and support by the community of gamers and game designers.

The latest version of Epic Games game engine is known as **Unreal Engine 5**, and developers and designers have free access to the game engine for creating, designing, debugging, and publishing stand-alone game and non-game applications on multiple platforms and target machines like PC, Xbox, mobile, augmented reality, and virtual reality.

Now, let's install and use Unreal Engine 5.