Ref: <https://www.studytonight.com/3d-game-engineering-with-unity/introduction>

What is a Game?

Well, you all have heard about the term **Game**. A Game can be defined as an activity enrolled for amusement as a prepared form of play that basically undertakes for enjoyment and/or as an educational tool.

## What is a Video Game?

A video game can be defined as a game that runs on electronic devices which involves humans interacting with a user interface(UI) for generating visual responses on any video device like TV screen or computer monitor. This electronic game when played by a user, deals with a set of graphics, images or even audio to make the game more interactive.

In simple words, video games are the digital entertainment platform (which is a form of software) that humans "play" via a computer, TV, smart phones, tablets or other gaming consoles.

### **Game Development**

Game development is the procedure of creating video games which involves working on some platform/software to develop the game. The development is undertaken by a game developer which can be one person or a team of **Game Engineers** (for constructing the overall structure and game play), **Designers** (for designing the objects and animations), **Coders** (for coding and giving life to the game including logics, score and other calculations), **Project Manager** (for managing and promoting the game), **Game Tester** (who will test the game after it has been developed to find bugs in the game, if any). All of these human resources come under Game developers and the process of developing the complete game is termed as **Game Engineering**.

### **Game Development Tools**

Game development tools are specialized software solutions which allow and facilitate the development of a video game easier. In developing a game, the team of developers may need animation software to design a player, or trees, or any other object being used in the game; or a coder may need **Visual Studio** or **MonoDevelop** editor to inject specific code to move a game object, all these tools come under Game development tools. In other words we can say that the tools required to develop the complete game comes under the tag-line of game development tools. All these tools helps in engineering a game.

# **Game Development Concepts**

Game development is one of the most exciting fields of computer science and a major part of the software development industry. Computer games comprise of a large and ever expanding market world-wide.

Interactive digital media and games along with entertainment applications have an enormous craze amongst the daily users of PCs and play an important role in providing economical strength(as games are not free), a factor which cannot be easily neglected.

So game development will also continue giving birth to new ideas and interactive devices for making the game play more attractive and exciting. For this game developers need to be well trained and equipped with their development skills.

### **Game Development is Software Development**

The steps and stages required for a game's development follow similar stages like that of software development, along with a few extra stages for successful completion of the game. Since game development is a major part of the software development industry, therefore game development also goes through the various phases of **SDLC (Software Development Life Cycle)** along with some extra phases. Let's explain these phases in details.

Software Development Life Cycle is a well-structured and arranged sequence of phases in software engineering for developing the intended software product. Same structure needs to be followed by a game developer also. These stages are:

1. **Communication:**

Here, the user initiates the request to develop a desired game. Then he/she contacts the developer or project managing firm and tries to discuss the terms. Then after a successful agreement, stage 2 will begin. If the user himself is a hame developer, then it starts from stage 2 directly.

1. **Requirement Gathering:**

In this stage, the game development team discusses the requirements to carry on the project and the project manager will decide the number of human resources required for the project. The team will carry out the discussion with varied stakeholders to discuss problems with various domains with a motive to bring out as much information as possible based on their requirements.

1. **System Analysis:**

In this stage, the developers will decide the roadmap of the plan for a successful game development till release and try to come up with the best software model (we will discuss about software engineering models in next chapter, in details) appropriate for the project. This phase also includes a proper understanding of the product's limitations or changes required in existing systems beforehand.

1. **Systems Design:**

In this phase of development, desired features and detailed work, which includes game-play, setting up of objectives and levels, screen layouts, player and game object model; creating animations in game, business rules, process diagrams (UML, DFD), pseudo-code and other documentations (GDDs) are done.

1. **Development Phase:**

The real code for your game will be written in this phase. This can be from a pseudo code or a set of algorithms written in the GDD (Game Design Document).

1. **Integration and Testing Phase:**

In this phase, a demo version of the game is released, with a trial period of 15 days or 1 month. This is done officially by the team itself to check for errors and popularity. With this partial release of game, the promotion is also started on websites like YouTube and other gaming sites. At the same time tester(s) are hired to check for bugs in the game.

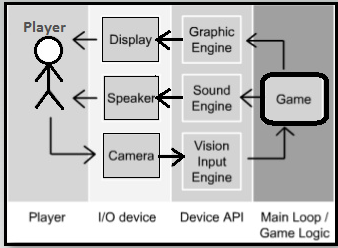
So all these stages must be followed to make a game and to make it successful.

### **Agile Model**

In this model, the product is broken down into a set of features, and hence it is used for quickly delivering a working product and so considered as a very rational development method. This model generates ongoing releases of your project, each having small and incremental changes updated from the previous released version. At each cycle, the project is tested and then released.

## Architecture of a Game

The architecture and structure of a game is similar to that of a software. But it does have some additional components which makes it different from a software. Every game has the following components:



* Graphics Engine
* Sound/Audio Engine
* Rendering & Vision-Input Engine
* I/O Devices (like, Mouse, keyboard, speaker, monitor etc)
* DLL files and Drivers/Device APIs

# **Game Engines**

For every game, game engine plays a major role since the game engine helps the game designers to bring characters of the game to life, by helping in scenes, characters and graphic generation, sound, artificial intelligence, scripting animation, networking etc. Game Engine is like an integrated development environment, with a readymade suite of visual development tools and reusable software components. It turns the complex task of game development simple, by providing an abstraction layer, which makes a lot of big tasks look very easy, while the game engine does all the hardwork in the background. In other words, it is a framework that is designed specifically for the construction and development of video games. Developers use these game engines for creating games for consoles, mobile devices and personal computers.

A Game Engine is created to develop games, just like any other IDE for any particular language programming. All the components in the game engine are built and integrated to support the motive of game development.

# **Different Genres of Game**

Genre of a game defines the exact category of the game and can be relayed through the similar gameplay characteristics, like - the type of objectives and storyline, the levels and camera point (i.e. FPS, TPS), the features and the storyline that the game is showcasing. Genre of a game is not defined by the content or the playing mode, but by the common challenges and characteristicss, that the game is having. For example, **FIFA** and **PES - Pro Evolution Soccer** have similar properties and objectives as both of them are soccer games and the player's get points or the levels of difficulty raises as the team wins the matches by scoring goals, like a real life football match. Genre of a game is decided by the resemblance found and listed under a common heading, here, FIFA and PES will come under *Sports-Genre Game*.

Ref: <https://en.wikipedia.org/wiki/Puzzle_video_game>

Puzzle games focus on logical and conceptual challenges. While many [action games](https://en.wikipedia.org/wiki/Action_game) and [adventure games](https://en.wikipedia.org/wiki/Adventure_game) include puzzle elements in level design, a true puzzle game focuses on puzzle solving as its primary gameplay activity.[[1]](https://en.wikipedia.org/wiki/Puzzle_video_game#cite_note-fundamentals-1)

Rather than presenting a random collection of puzzles to solve, puzzle games typically offer a series of related puzzles that are a variation on a single theme.

### Trial-and-Error**[**[**edit**](https://en.wikipedia.org/w/index.php?title=Puzzle_video_game&action=edit&section=6)**]**

This sub-genre includes point-n-click games that often exhibit similarities with adventure games and walking simulators. Unlike logical puzzle games, these games generally require [inductive reasoning](https://en.wikipedia.org/wiki/Inductive_reasoning) to solve. The defining trait is that you must experiment with mechanisms in each level before you can solve them. Puzzle elements often do not have consistency throughout the game, and thus require guessing and checking.

These include [*Myst*](https://en.wikipedia.org/wiki/Myst), [*Limbo*](https://en.wikipedia.org/wiki/Limbo_(video_game)), [*The Dig*](https://en.wikipedia.org/wiki/The_Dig_(video_game)), [*Monument Valley*](https://en.wikipedia.org/wiki/Monument_Valley_(video_game)), and [escape room](https://en.wikipedia.org/wiki/Escape_the_room) games such as [*The Room*](https://en.wikipedia.org/wiki/The_Room_(video_game)).

Ref: <https://indiegamedev.net/2020/02/11/comparison-of-game-engines-2020/>

Choosing a game engine:

Choosing the right game engine comes down to personal preference. It depends on the answer of the question, what type of games do I want to make? For example, do I want to make a game on Roblox? Maybe, an RPG? If so, you can just use the OGRE engine, or RPG Maker engine. That’s not to say that it has to be those engines in order to make those games.

## [Unity](http://unity3d.com/)Game Engine

|  |  |
| --- | --- |
| Pros | Cons |
| * Beginner Friendly | * Unity is heavy, takes a lot of space on your hard drive |
| * Cross-platform friendly | * Even small games are built with a large .exe size |
| * Excellent asset store | * Does not offer grants |
| * Cheap cost / free to use | * If your games profit 100k/annually, you have to use Unity Pro (which is fair, but could be a con if you don’t want to pay a monthly fee) |
| * Endless possibilities | * Unity is heavy, takes a lot of space on your hard drive |

## [Unreal](https://www.unrealengine.com/)Engine

|  |  |
| --- | --- |
| Pros | Cons |
| * Known for AAA game development | * Need a licensed copy for working |
| * Backed by Fortnite | * Not beginner friendly |
| * More tools | * More suitable for a team of developers |
| * Asset store | * Need a licensed copy for working |
| * More efficient rendering technology | * Not beginner friendly |
| * Offers grants | * More suitable for a team of developers |

## [RPG Maker](https://www.rpgmakerweb.com/)

Are you interested in just making a 2d rpg game? Then RPG maker could be a good choice, as it has an easy learning curve.

However, as the nature of the intended game is a 3D puzzle game, the engine was excluded.

## [Godot](https://godotengine.org/)

Godot, is another great choice to choose from, it’s very flexible meaning that you could make 2d/3d games. It’s open source, and all the work you develop, is 100% yours. You own all the rights to it, and you won’t need to pay any fees/royalties in the future. This is a great choice for an indie game developer, but you need to take into account that there isn’t as much documentation, guides/videos as Unity or Unreal as the community is much smaller for this Engine.

It boiled down to either Unreal Engine or Unity Engine. And Unity was ultimately selected for the following project specific reasons:

* + Graphics are meant to be simple and cartoon-y for the purpose of the stylized game, therefore Unreal’s edge in ways of superior graphic quality was rendered irrelevant.
  + Beginner friendly: As the author both had some previous experience with Unity, and it is already more beginner friendly for learning purposes. The delay having to familiarize with UE’s environment was another setback against it.
  + Free to smalltime monetization:
  + Access to free assets and tutorials. As Unity is geared more towards a vaster audience it would be more comfortable for a quick development process.