OFFLINE GAMING VS CLOUD GAMING (ONLINE GAMING)

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Abstract—Games has always been a major source of entertainment in every generation and so exiting their history is, because it has various factor involved like Video Games Industry and various generations of video games. Due to improvements in graphics, a revolution has occurred in computer games. Storage for Video Games has always been a problem whether it is a Gaming Console or a PC but has been resolved generation by generation. Games also attracted the uninterested audience. Offline Gaming has been very popular for a year but has various drawbacks. Cloud Gaming is the resolution against Offline Gaming. This paper talks about how Cloud Gaming is taking place of Offline Gaming with much powerful hardware systems and processes.

Keywords—Gaming, Cloud Gaming, Gaming PC, Gaming Console, Video Games.

I. GAMING AND ITS HISTORY

Computerized game playing, whether it is over a personal computer, mobile phone or a video game console can be referred to as Gaming. An individual who plays video games is recognized as a gamer [1]. In every generation of technology evolution, graphics of the game have been improved.

When we think the history of video games we usually think of games like Tic-tac-toe, Tetris, Pacman, pong and many more but now these games use graphics seems like reality. In the 1950s, People can't think of playing card games such as Solitaire, Blackjack, Hearts, Spider Solitaire and so on, on tv or computer but now the stage has reached more ahead from that [1].

The revolution started in the 1950s when computer experts started planning simple games and mockups as a piece of their study with the advancement in technology Video Game Industry had reached far more beyond the real world. During the 1950s the computer games were divided based on 3 categories: i) research programs in artificial intelligence and ii) demonstration programs expected to inspire or engage people in general and iii) training and instructional programs. Since these recreations were created on extraordinary gear in a period while porting between frameworks was tough and were frequently disassembled or likely of in the wake of satisfying their constrained requirements [2].

Alan Turing and David Champernowne both develop chess PC game called Turochamp, in 1950 but could not really be executed by them on a PC [3]. During the 1970s and 1980s, Video gaming had failed to reach through quality, video games and consoles use joysticks, buttons, and different controllers, at the

side of visuals on pc screens and home-based pc games were announced to the final public. The first generation of home consoles came, as well as the beloved game pong and numerous "clones" during the 1970s. Giant coin-operated video arcades machine decorated with graphics was common at malls, Atari 2600 reasonable home consoles were loved by the people and people play games on their home TVs because of Intellivision [4].

1980s was the age of growth in video game industry. In the 1990s, three-dimensional graphics were introduced with video game console markets such as Nintendo and Sony's PlayStation. These consoles have incredible visuals and now the gaming industry was targeting youths along with kids [5]. After the 1990s, handheld games and PC gaming also became popular. Online gaming and cellphone games become key parts of gaming culture during the era of 1998 to 2013. Some eight generation consoles were also introduced with Nintendo Wii U and Nintendo Three-Dimensional Screen is known as Nintendo 3DS, Microsoft's Xbox One and Sony's PlayStation 4 and Play Station Vita [3].

An outsized market share in Asia and Europe for PC gaming ruled for many years and remain to grow because of digital dispersion. Since the expansion and extensive shopper usage of cell phones, mobile gaming has been a ground-breaking issue for games, as they can reach individuals those who are oblivious to in gaming, and people incapable to afford or support required hardware, like game consoles [3].

II. THE NEED FOR VIDEO GAMES

Games are vital as a result of they're designed to challenge and train human psychological feature [6]. As asserted by Richard E. Mayer [7] computer games are very helpful in improving and boosting learning capabilities.

Richard E. Mayer has taken many questions in his paper to prove the need for Video Games (Computer Games). Richard E. Mayer also mentioned some books that suggest that games will improve the learning process and students will learn better by playing Video Games (Computer Games). An earlier analysis of Richard E. Mayer says that the science of learning can be applied to education [13].

This paper focuses on the comparative analysis of Offline Gaming and Cloud Gaming in five Sections. Section II (Traditional Gaming/Offline Gaming), presents the offline gaming and their hardware requirements, the section also mentions the differences between Gaming PC and a Regular PC and the need of improvements in PC or Console Storage. Section III (Online Gaming/Cloud Gaming), presents Cloud Gaming also describes its working with some of its

architectural features. Section IV (Offline Gaming Vs Cloud Gaming), presents a comparison between Cloud Gaming and Offline Gaming on technical grounds and performance.

Section V concludes the research paper by justifying the effective use of Cloud Gaming based on its efficiency that which one is better Offline Gaming or Cloud Gaming.

III. TRADITIONAL GAMING OR OFFLINE GAMING

Offline Gaming can also be referred to as Thick Client Gaming or Fat Client Gaming. A Thick Client refers to a PC you buy from a store which has a lot of RAM, a Hard Disk, a complete working Operating System and can run numerous application software's. These computers are connected to the internet to get the needed data. Computers with high specifications are used for gaming.

Every game has its own minimum specification requirements to run. For example, Games like Grand Theft Auto V (commonly known as GTA 5), Watch Dogs, Farcry needs a minimum CPU requirement of Intel Core 2 Quad Q8400 or AMD Phenom II X4 940, RAM of 6 GB, OS of Windows 7 or Windows 8 or Windows 10 and required Free Disk Space of 65 GB which can cost a gamer a lot for a Gaming PC [8].

A Gaming PC has all the things that a Regular PC has but there is one major variance between a Gaming PC and a Regular PC that is a higher end separate GPU which is also known as Graphics Card. Games request a level of graphics for execution that a normal PC cannot deliver using the graphics processing that's already assembled into the CPU [10]. Some other features are also there that makes a Gaming PC different from a Regular PC as listed below-

1) *High Speed Unlocked CPU, unlocked means a CPU which can be overclocked.*

2) *High-End Cooling, there are High-end CPUs and GPUs which generate heat and to keep that machinery cool Hight End Cooling is needed.*

3) *High Speed, Overclocked, heatsinked RAM*

4) *High-End Audio, which has a premium sound.*

5) *Performance Storage, use of SSD can also improve the performance.*

Storage has always been a problem for games whether it is a PC or a Gaming Console. As game technology has always been improved year to year, the size of their disk usage has also increased year to year. In the gaming era of the 80s and

90s, the games were actually stored in megabits and were available on cartridges.

The SNES (Super Nintendo Entertainment System) also uses cartridges to store games with sizes range from 0.23 Megabytes to around 4 Megabytes. After that in 1982, Atari 5200 boasts came up in the market which has the maximum storage capacity of 111.5 Megabytes of Data at that time. But then sixth generation consoles came up in the market which leaves behind the old cartridges and uses discs. In 2001, the first Nintendo Console GameCube was introduced which uses Optical Disks and have Memory Cards to store save game data which range in size from half Megabytes to 16 Megabytes.

In competition, Microsoft also released its first Console XBOX with 8 GB of internal storage and optional 8 MB of Memory Cards to store or transport data and Sony introduces it's PlayStation 2 which offers 2 Memory Cards of 8MB to plugin for storing save data [9]. But nowadays we need at least 500 Gigabytes of storage whether it's a Gaming PC or a Gaming Console with a fast GPU and RAM.

The next section focuses on these set of requirements by progressing towards Cloud Gaming with the advancement in technology the need to develop all-time game availability with high computing/processing speed, clear graphics, and optimal storage requirements have become a constant cause of concern.

IV. Cloud Gaming/Online Gaming

Cloud Gaming or Online Gaming can be referred to as Thin Client Gaming. Cloud Gaming is another route by which complicated games are conveyed to gamer which executes on high-powered servers, the game frames are delivered over the internet on heterogeneous computers.

Cloud gaming support game-on-demand benefits over the web. Cloud Gaming serves various advantages- It enables simple access to games without owning a Gaming PC or Gaming Console or high-end graphics processing units (GPUs) it makes the game handling and supplies much easier. Figure 1 shows how cloud gaming services work.

The cloud gaming platform runs pc game programs, which might typically be isolated into 2 segments: (i) game logic that's guilty to translate gamer directions into in-game interaction, and (ii) scene renderer that set up game frames in a period of time. The gamer directions originate from the command translator or directions translator, and therefore the game display is captured by video capturer into videos, that gets compressed by video encoder. The direction translator, video capture, and video encoder all are the parts of the cloud gaming

platform.

The cloud gaming platform delivers the video packets to and receives user inputs from thin clients utilized by gamers for enjoying games. It's a thin client, as solely 2 low-complicated elements are needed: (i) direction acceptor, that links to the game controllers, like gamepads, joysticks, keyboards, and mouse, (ii) video decoder, which may be accomplished by accepting densely created decoder chips. [11].

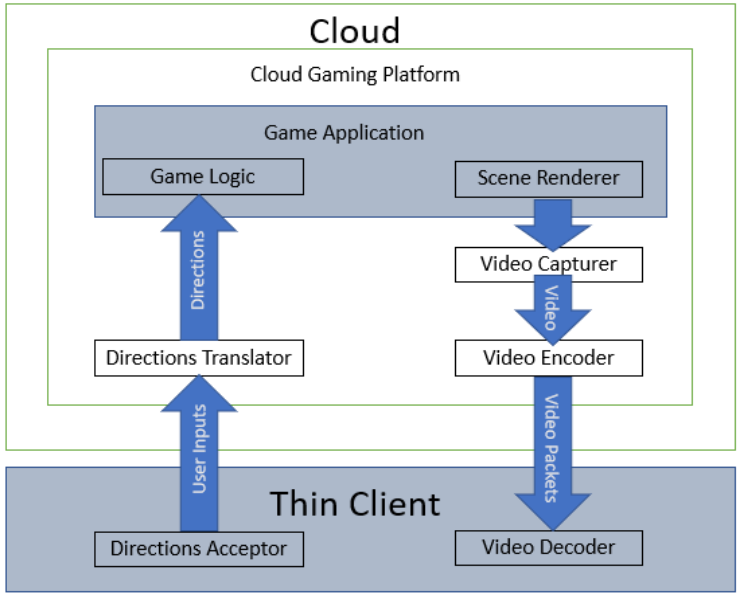

Fig 1. Cloud Gaming Services [10]

V. Offline Gaming Vs Cloud Gaming

Offline Gaming is known as Thick Client Gaming because it needs a physical system with a load of RAM, Hard Drives, a Good GPU and a gaming compatible Operating System. Whereas in comparison to Offline Gaming, Cloud Gaming which is also known as Thin Client Gaming does not need a lot of RAM, Hard Disk, a Good Graphics Card (GPU) instead of cloud games can run on your old low-end PC very well, what your old low-end Gaming PC needs is just some space for the cloud gaming software on which gamer will play cloud games, a working operating system on which the cloud gaming software will run and a very good internet speed.

Internet Speed may vary from provider to provider but it is recommended to

keep the downloading speed to 15 Mbps for a smooth gaming experience [12]. For Offline Gaming gamer have to buy games as well which gamer want to play, with the gaming hardware's and have to wait to play the game till the game doesn't install on gamers system but in Cloud Gaming gamer just have to create an account on the website of Gaming Provider and have to install the software then you can choose your game from the list of games and you are good to go.

Offline Gaming is Operating System dependent whereas Cloud Gaming is Operating System independent what you need to do is just log in to your account in the software on any device and gamer can play the games anywhere he wants. Some Cloud Gaming Providers like Liquid Sky also provide computer games to be played on Android Mobiles as well [12].

Table 1- Difference between Offline and Cloud Gaming

Key Features	Offline Gaming	Cloud Gaming
RAM Required	High	Low
Requires Hard Disk to Store Games	Yes	No
A Working Operating System	Yes	Yes
Requires a dedicated GPU for Gaming	Yes	No
Regular Upgradation and Maintenance requirement	Yes	No
Operating System Independent	No	Yes
Cost Effectiveness	Expensive	Less Expensive
Can Overclock the Hardware According to Need	Yes	(Depends on provider to provider)

High-Speed Internet Connection Required	No	Yes

While playing Offline Games gamer have to upgrade his PC regularly for the smooth gameplay and its costs more than buying an account from the Cloud Gaming service provider. The table given below compares the Cloud Gaming and Offline Gaming on some listed basis.

VI. CONCLUSION

This paper, after reading the technical comparison between Offline Gaming and Cloud Gaming, this paper can conclude that Cloud Gaming is way better than the Offline Gaming with one strong disadvantage that Cloud Gaming requires a High-Speed internet connection to run.

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