UDC 004.7

# TRENDS AND FUTURE OF CLOUD TECHNOLOGIES IN GAMING INDUSTRY

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## ПЕРСПЕКТИВИ ТА МАЙБУТНЄ ХМАРНИХ ТЕХНОЛОГІЙ В ІНДУСТРІЇ ВІДЕО-ІГОР

Доповідь містить короткий огляд на поточні досягнення та історію розвитку в області хмарного геймінгу, технології що використовуються для забезпечення роботи хмарних сервісів, переваги і недоліки даних технологічних рішень для користувачів, складності в розвитку цього напряму та перспективи і вимоги до сервісів на найближче та віддалене майбутнє.

This article briefly describes the actual achievements and the history of cloud gaming development. The authors will overview the technologies that were used to ensure work of the services, pros and cons of decisions made in this sphere for users, peculiarities of trends and future development of cloud services and cloud gaming in particular.

Cloud computing is the availability of resources via any means of remote communication. The most data are transmitted over the Internet. A lot of work and especially data are stored in outsource servers and data centers. For business it brings reliability as remote storages and computing resources protect the workflow from any downtime or blackouts. Meanwhile, for users the perks are not so obvious, they may vary from sphere to sphere, so particular cloud gaming is to be discovered in the article [1].

Traditional means of gaming is something, wherein a game is launched locally on user's console, personal computer, or mobile device. Cloud gaming is sometimes regarded as gaming on demand that runs games on servers and streams the image to user's device, in other words, it is playing a game in a cloud.

The pioneer of cloud gaming technology idea was the global corporation called G-cluster which demonstrated it at E3 in 2000 [2]. The developers offered service used over Wi-Fi to handheld devices. This idea was not taken seriously and didn't get any support. With development of broadband internet more service providers started thinking if they could connect a user to a game launched on their services without making gamers download the software. Residents of Ukraine as well as other Eastern-Europe citizens might have seen the advertisements starting year 2015 about services that offer a possibility to play "demanding to resources" games using a low-tear hardware. The only thing needed was the reliable internet connection. Most of them had no-name and had much technical trouble. That was a reaction for loud start

of such platforms on the west: in USA and Europe. Yet there was lack of availability in CIS (The Commonwealth of Independent States), the services were limited strictly in a number of countries. Most popular platforms such as GeForce Now and Google Stadia released in 2015 (2017 for PC) and 2019 respectively.

For cloud gaming services - significant infrastructure is required for the service to work as intended such as data centers and server farms to store the resources for games and high-bandwidth internet connections that also requires low latency to stream the image to users. As for the users – vise versa – it relieves common gamers from being forced to update their computers and have any difficulties with setting the game to work properly.

Having the Google stadia as an example of the mark of the situation shows that despite of much internet service providers progress – yet the latency is not satisfying. The ping via service may vary from 50 or 500 milliseconds while a user of a PC or console should have 5 to 15 milliseconds. There is a list of other differences to consider: ownership, price, availability. In services like Google Stadia, a system of subscription works: if you stop paying monthly, you lose all the purchased in-store goods. Yet this may be fixed by using a bound Steam account. The price for this service is just 10 USD/monthly that saves you from buying a 1000 USD personal computer or 500 USD gaming console. Especially when the prices for GPU are rising constantly. Last but not least is availability. Not everyone has a reliable internet-connection, while offline is not an option for any cloud technology. Yet an autonomic device may be handled where you can access electricity. Laptops have even more autonomy in the last case [3,4].

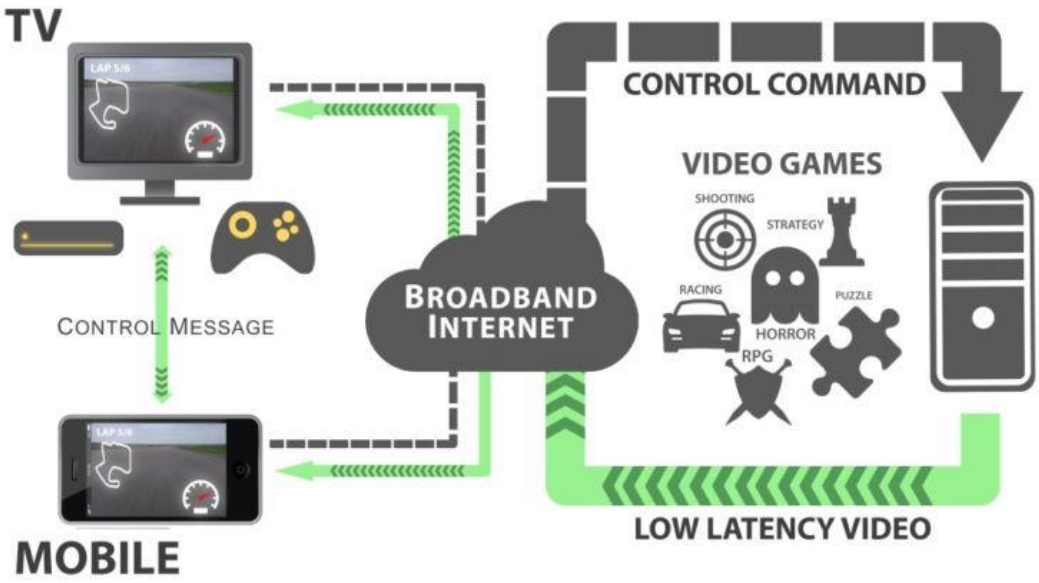


Fig.1. Schematic of cloud gaming.

There is also a different type of cloud tech presented world-wide. The most popular virtual video-game store launched their own app for mobile devices called

Steam Remote Play that uses your PC as a server and your phone as a controller (command input) and video output [5]. This decision seems really good for single-player games as your phone is connected to your home means that server is not far from you. With availability of 4G in the underground it gives users an opportunity to connect to home PC computing resources from their smartphone being anywhere in the city.

To sum up, the cloud technologies are rapidly developing and becoming more and more popular. Casual gamers with low-tier devices and mobile users may rent services to play for a reasonable price, while for hardcore gamers there is a possibility to play their favorite titles via Google Stadia and Steam Remote Play. On the other hand, it is available only within stable internet connection and has no autonomy from subscription (except for Steam Remote Play that is free) [6].

All the servers have similar aims for the future. To make possible GPU resource sharing and predict user's input. Today most services have a GPU dedicated to each person playing a game. The idea is to schedule its resources with the purpose to improve streaming scalability. Another algorithm developed to predict player's input. That must overcome the impact of latency in cloud gaming applications. The last one can even bring some applications to "negative latency" where an action is done even before the input was made.

In conclusion, it is important to note that the cloud gaming market is growing much faster than it was predicted. In 2016 its general value was 56 million USD. By year 2019 it grew up to 512 million and in 2021 it is going to pass the mark of a billion value. We can see that this industry is developing rapidly and have a lot to cover in future. Cloud computing might be a great solution for a range of tasks in the nearest future.

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