

How to Leverage 5G with Cloud Gaming

“Telcos are actively looking for new, innovative services, such as game streaming, to differentiate their offerings, increase revenue growth, and reduce churn. Thanks to 5G, telcos can now address new opportunities by offering streaming of high-quality video game content to the mass market with the same customer experience as a video console.”

- Javier Polo, CEO, PlayGiga.

Executive Summary

Much like music and TV in the past, gaming is now moving swiftly to the cloud as 5G promises to create new use cases and enable gaming anytime, anywhere, on any screen. This requires addressing tuning and optimization of network components to maximize performance, grappling with latency to enhance the unique responsiveness of gameplay, and ensuring that operational costs and capital expenses are managed effectively.

PlayGiga needed to provide its customers with a reliable and cost-effective way to bring cloud gaming to the masses. This case study explains how PlayGiga leveraged Intel's ecosystem—including 5G expertise, high-performing chipset, and cost-effective scalability—to create a platform that meets the needs of telecommunication companies (telcos) and communication service providers (CoSPs) to offer gaming-as-a-service (GaaS) to their customers.

Challenge

Develop a platform that would:

Create a new gaming market: PlayGiga needed a GaaS solution that would enable CoSPs and telcos to build a new revenue channel, create sticky services for their customers and grow their markets.

Ensure responsive gameplay: The challenges to providing satisfying gameplay over the cloud requires a reference architecture for the visual cloud that is capable of handling heavy workloads, compressing rich media content efficiently, and accommodating high numbers of users without service slowdowns.

Leverage the possibilities of 5G: Rapidly evolving network technologies—including 5G—create a push for unique services that help a brand gain recognition and differentiation in a densely-packed marketplace. PlayGiga needed a partner that understood 5G and could help shape technologies to take advantage of it.

Solution

PlayGiga chose Intel's Visual Cloud platform that delivered:

High end compute and graphics performance on a single chip: The 8th generation Intel® Core™ i7 processor with Radeon™ RX Vega M Graphics delivers excellent performance for gaming workloads.

Low OpEx and latency: Using the Intel chipset has been shown to reduce OpEx.¹ Reducing OpEx can create a profitable business case for CoSPs and telcos with the low latency responsiveness that gamers expect.

5G know-how: CoSPs and telcos are looking for ways to monetize their 5G investments and cloud gaming is one answer. Intel's 5G expertise provided PlayGiga the fundamental components to create their service offering.



The Explosion of Cloud Gaming on 5G

Internet gaming traffic is forecast to increase ninefold from 2017 – 2022, according to the [Cisco Visual Networking Index, Forecasts and Trends, 2017 – 2022](#), representing a compound annual growth rate (CAGR) of 55 percent. Fifty-three percent of existing PC gamers on Steam* do not meet the minimum hardware requirements to play the latest AAA games², such as Assassin's Creed* Odyssey or Fallout 76*. Cloud gaming reduces these barriers. In the same way that digital music delivery and on-demand video streaming of movies and shows have taken hold, game streaming is now becoming established as the supporting technologies have matured. The specialized tuning of cloud components to support gaming effectively is creating a new visual cloud model that meets the high-demand workloads.

The foundation underlying this explosion of game streaming requires a distinct combination of technologies, including the benefits provided by visual cloud components engineered by Intel, ranging from specialized computing and network hardware to Intel frameworks and optimized open-source software for the visual cloud.

Faster Processor with Built-In Graphics

The model that PlayGiga has developed to launch gaming-as-a-service worldwide takes advantage of the capabilities of Intel Core i7 processor with Radeon RX Vega M Graphics. This processor features discrete graphics bundled into the same package, providing high frame rates that translate into fluid gameplay. Bandwidth demands are met by processor delivery of data to as many as 24 graphics compute units with a maximum boost frequency as high as 1190 MHz. Further performance is gained from dedicated graphics memory—4 GB High Bandwidth Memory Gen 2 (HBM2) that can achieve a bandwidth up to 205 GB per second, adding high-speed capabilities to the graphics pipeline.³ Overclocking of the CPU, GPU, and HBM2, which is supported by this processor, boosts performance even further, providing a capable, cost-effective solution to meet the processing requirements of PlayGiga's GaaS platform.⁴

High-performance game streaming requires a distinct combination of compute operations. The rendering of 3D games in a visual cloud server takes place with instant encoding of each frame, following by streaming in the correct format to any devices connected through wired or wireless broadband links. By integrating compute and graphics processing capabilities onto a single chip, this advanced processor delivers right-sized performance for gaming workloads.

To PlayGiga, this combination of features in a single Intel processor proved a perfect match for their engineering and business requirements. One essential requirement of the GaaS platform was to be able to overcome the latency issues that have previously made cloud gaming less responsive, discouraging prospective users and leading to an unsatisfying game experience. The PlayGiga engineering team developed a platform solution that took advantage of their own unique technologies developed in-house and used the performance capabilities of the Intel Core i7 processor with Radeon RX Vega M Graphics to accelerate critical operations, such as graphics rendering and video encoding.

Edge computing offers future performance advantages as well, placing data center or network-class compute and storage resources away from hubs and closer to (or on) smart endpoint devices. As edge computing gains momentum, PlayGiga is working with Intel engineering teams to integrate this technology into future cloud gaming offerings.

Cost-Effective Platform Lower Operating Expenses

Another factor that influenced PlayGiga to select Intel as part of their GaaS service development was cost. Using the Intel chipset reduces OpEx by as much as 50 percent¹ through better power management and space requirements, creating a profitable business case for telcos/CoSPs (Communication Service Providers).

Originally, PlayGiga started out using specialized graphic cards from other vendors that proved to be too expensive for meeting the business goals, hindering their ability to scale a cloud-based subscription service to the masses. Both the capital expenses (CapEx) and operating expenses (OpEx) turned out to be too high.

A collaborative engagement between Intel and PlayGiga began close to three years ago and testing that was performed helped improve optimization for a chipset that was under development. VP of Business Development Santi Magazú said, "We worked closely together to try different use cases on Intel architecture platforms. That really helped us lower the cost of the platform (or the CapEx). We are now able to ensure high-quality rendering, delivering a quality user experience while still keeping the unit cost in CapEx under control."

Low Latency Responsiveness

Santi said, "One of the biggest problems with cloud gaming is the latency. You don't want too much latency because it affects the streaming video. With cloud gaming, the communication is bi-directional, displaying screens of the game in progress, but also handling controls and instructions from the app. The response when controls are issued has to be less than 30 milliseconds for a good experience on top of the latency."



“We also have an adaptive bit rate,” Santi continued. “We normally screen at 720p and set the frames per second, but we can increase to 1080p at 60 frames per second. That lets us adjust the quality of the solution, which is very handy, especially in geographies where the quality of the network is not ideal.”

To achieve latency numbers consistent with a good experience for gamers, PlayGiga worked with Intel to improve memory transfers within the Radeon RX Vega M Graphics GPUs at the driver level and adapting routines from the available graphics SDKs.

5G Network Expertise

As 5G network services mature and become available in more and more regions around the world, telecommunication firms are rethinking their approach to services and considering the ways in which they can capitalize on the innovative opportunities 5G networking offers. “The telco today is looking for ways to convince a customer as to why they should adopt 5G.” Javier said. “That is where cloud gaming fits in. Given the need for low latency, cloud gaming is an ideal use case for 5G technology. This is very important for telcos because it is a way for them to monetize the 5G technologies that are arriving.”

Intel's long-standing efforts to create the building blocks that enable 5G networking and expand the ecosystem around it, as well as providing the architecture for building the visual cloud, gave PlayGiga the fundamental components to create their service offering. PlayGiga is working with Intel on solutions that take maximum advantage of the opportunities presented by the adoption of 5G. PlayGiga has integrated these capabilities into their service platform in anticipation of the coming boom market. From a cloud gaming perspective, the result of this collaborative work is a robust, cost-effective solution that scales to the massive volumes of content required to service large numbers of game subscribers.

Gaming-as-a-Service Provides Differentiated Offerings for Telcos

The technologies and cloud-based service platform that PlayGiga has developed for enabling gaming-as-a-service provides the following benefits:

- **Easy adoption path for families:** PlayGiga's service removes common gaming obstacles and provides an easy click-and-play gaming experience.
- **Wide selection of premium game titles:** Over 200 titles are in the catalog.
- **No games downloads required.** Streamed game content on demand offers immediate playability.
- **Exceptional user experience for gamers:** Responsive, low-latency gaming experience compares with console gaming.
- **Clear path to monetizing 5G network services:** GaaS gives telcos a direct means to encourage consumer adoption of gaming-as-a-service, increasing revenue and reducing churn.
- **Infrastructure options give telcos a choice:** deployed as an on-premises solution or as a hosted solution managed by PlayGiga.
- **Easy business model** for telcos based on a simple revenue share.

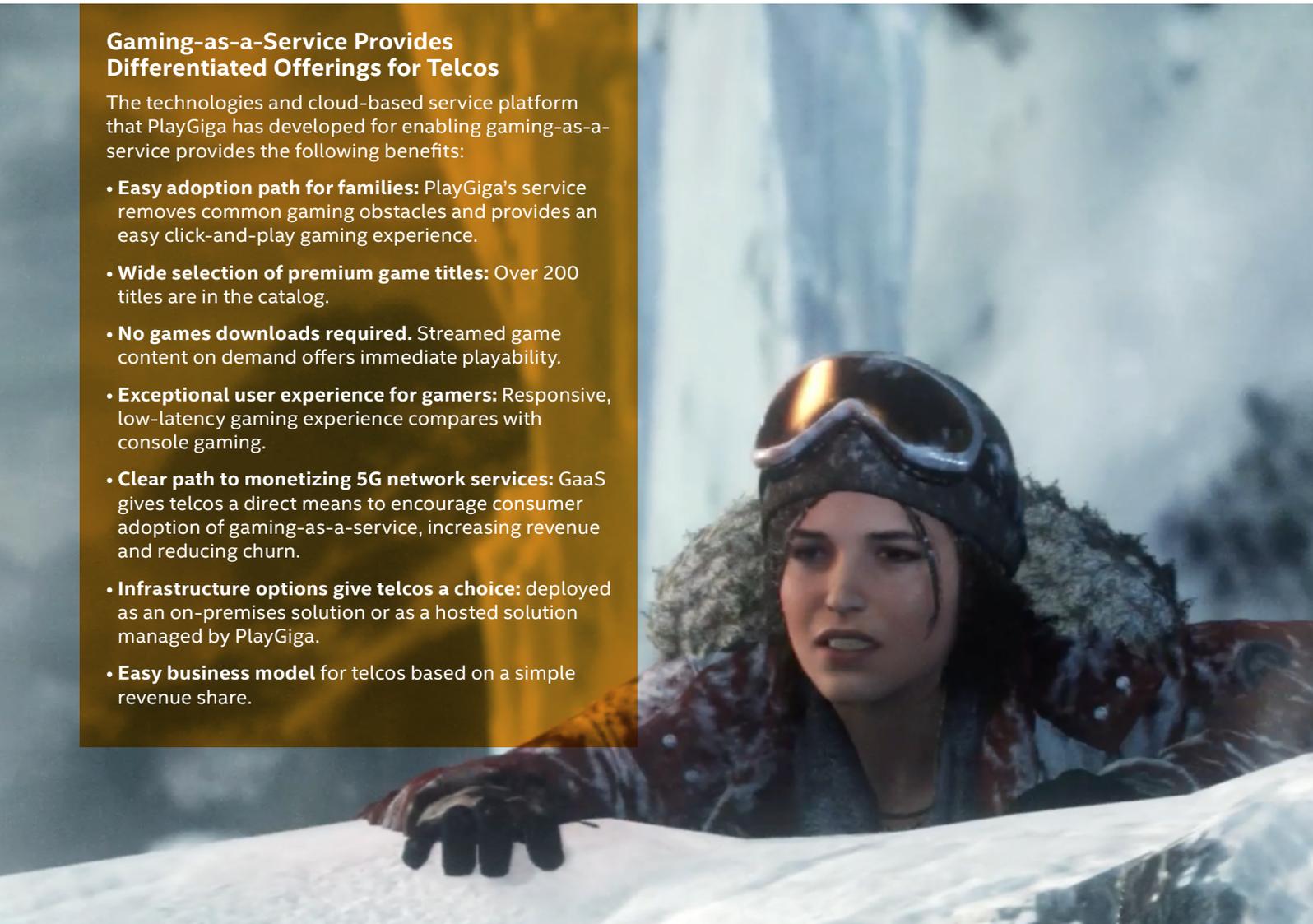


Figure 1. Access to responsive, high-quality games over 5G provides a strong attraction for subscribers.

Intel is Driving 5G Innovation

Through technology advances and support for key trials worldwide through the Intel® 5G Mobile Trial Platform, Intel is helping accelerate commercial solutions for 5G and expanding business opportunities across many different industries.

Among the hardware milestones helping shape 5G network launches, the Intel® XMM™ 8000 modem series provides dual support for both sub-6GHz bands and mmWave spectrum. For applications requiring low latency, such as PlayGiga's GaaS, this modem series delivers the high-volume throughput and responsiveness needed for streaming game content.

Intel is also developing the components for building network infrastructures capable of deploying and launching high-demand applications that can scale to handle high-resolution graphics content. The visual cloud hardware architectures being engineered at Intel and the software solutions being developed to support visual cloud workloads are addressing the rising importance of digital services and rich media content distributed daily in growing volumes.

5G networks, powered by Intel, represent a transforming force that will reshape many different aspects of connectivity in modern life, including smart homes, smart cities, connected vehicles, smart agriculture, connected healthcare, and smart media. Through collaborative work with companies such as PlayGiga, Intel continues to unlock commercial opportunities and fuel new enterprises.

A study by Ovum commissioned by Intel, *5G Economics of Entertainment Report*, forecasts that between 2019 and 2028 the experiences enabled by 5G networks will provide revenue opportunities close to USD 1.3 trillion.

“5G will inevitably shake up the media and entertainment landscape. It will be a major competitive asset if companies adapt. If not, they risk failure or even extinction. This wave of 5G transformation will not be the purview of any singular industry, and now is certainly the time for all business decision makers to ask: Is your business 5G-ready?”²

- Jonathan Wood, General Manager of Business Development & Partnerships,
5G Next Generation and Standards, Intel Corporation

For more information, visit the [Intel 5G microsite](#).



Figure 2. PlayGiga's service expands streaming gameplay to mainstream titles.

The Visual Cloud by Intel

With visual computing workloads growing at an accelerating pace, cloud service providers (CSPs), communications service providers (CoSPs), and enterprises are rethinking the physical and virtual distribution of compute resources to more effectively balance cost and deployment efficiency while achieving exceptional performance. Contending with the onslaught of new visual workloads will require more nimble, scalable, virtualized infrastructures; the capability of shifting workloads to the network edge when appropriate; and a collection of tools, software, and hardware components to support individual use cases.

Intel's visual cloud computing consists of a set of capabilities for remotely consuming content and services that center around efficient delivery of visual experiences from the cloud—both live and file-based. Additionally, visual cloud includes media analytics applications that add intelligence to video content. As shown in the figure below, the visual cloud has five major workloads.

Visual Cloud Workloads

All workloads require high performance, high scalability, and full hardware virtualization

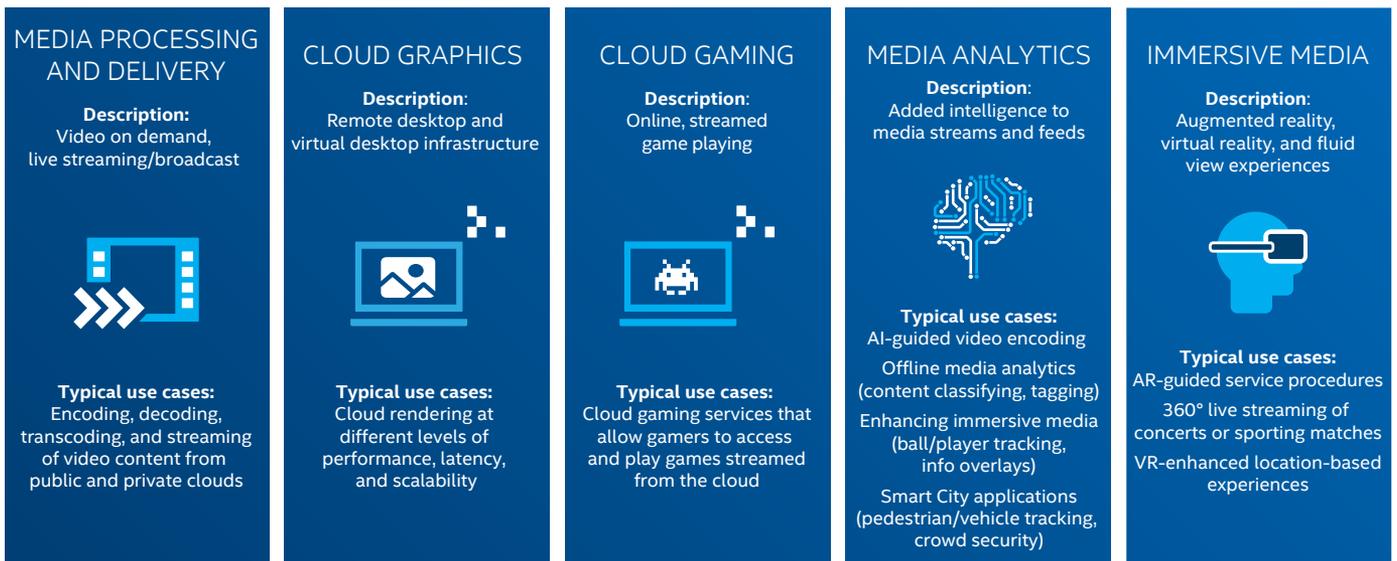


Figure 3. Visual cloud workloads based on Intel® technology encompass different visual experiences.

For more information, visit www.intel.com/visualcloud

“Intel and PlayGiga are expanding the possibilities in the cloud gaming segment by enabling rich experiences on virtually any device, anytime, anywhere. Intel® Core™ i7 processors with Radeon™ RX Vega M Graphics, along with Intel's leadership in 5G networks, are helping PlayGiga deliver an amazing user experience across a wide range of highly interactive games.”

- Lynn Comp, Vice President, Data Center Group, and General Manager, Visual Cloud Division, Intel Corporation



Figure 4. With GaaS, the same gaming experience across any pane of glass is now possible.



¹ Based on the monthly hosting cost for power consumption and connectivity of an actual quotation from one hosting service provider in Spain, as of December 2018. PlayGiga estimated a 50% OpEx reduction based on a comparison of the monthly cost per concurrent user with the absolute cost figures calculated for a full rack.

² Based on the minimum system requirements for those games. Sources: https://store.steampowered.com/app/812140/Assassins_Creed_Odyssey/, <https://www.pcgamesn.com/fallout-76/fallout-76-system-requirements>, and a survey of Steam user's systems in December 2018 (<https://store.steampowered.com/hwsurvey/Steam-Hardware-Software-Survey-Welcome-to-Steam>).

³ 8th Gen Intel® Core™ Processors product brief. <https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/8th-gen-core-family-mobile-g-series-brief.pdf>.

⁴ Altering clock frequency or voltage may damage or reduce the useful life of the processor and other system components, and may reduce system stability and performance. Product warranties may not apply if the processor is operated beyond its specifications. Check with the manufacturers of system and components for additional details.

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