ERICSSON

together with inCode

5G cloud gaming

Driving revenue growth for service providers

August 2022

Executive summary

Contents

Authors:
Richard Rosmarin
Raj Sonak
Tomislav Marcinko

Acknowledgments:
The authors would like to thank and acknowledge the contributions and feedback from their colleagues: Praveen Arora from Ericsson Global Consulting, Peter Linder from North America Marketing and Greger Blennerud from Strategic Marketing.

North American communications service providers have invested substantially in 5G networks to enable multiple use cases, leveraging capabilities like network slicing and edge computing.

As service providers seek to monetize 5G in the short term, cloud gaming, the technology that allows subscribers to play games anywhere and from any device, presents a new and exciting opportunity to drive revenue growth.

Although still a relatively new technology, cloud gaming is gaining traction among consumers, yet service providers are unsure about its monetization potential.

To help provide clarity, inCode, the strategy consulting arm of Ericsson North America, evaluated the market trends of this technology in the region and estimated the potential benefits for service providers.

The study sought to answer the following key questions:

1. What will be the market adoption of 5G cloud gaming in North America?
2. What will be the subscriber willingness to pay for enhanced connectivity for 5G cloud gaming?
3. What impact will cloud gaming have on the network capacity?
4. What will be the service provider's incremental revenue due to offering enhanced connectivity for cloud gaming?

Key learnings

inCode studied the major drivers of cloud gaming and forecasted its adoption in North America:

- Cloud gaming is expected to reach 99 million 5G subscribers over the next decade in North America; approximately 23 percent of 5G subscriptions.
- inCode identified two cloud gaming segments for enhanced 5G connectivity: one willing to pay USD 10.99 more for an advanced performance gaming slice, and another willing to pay USD 5.49 more for a moderate performance gaming slice, on top of a 5G subscription.

To estimate the business opportunity for service providers, inCode simulated a 5G network that serves cloud gamers and mobile broadband subscribers through three slices, each with specific minimum speeds, latency requirements, and traffic contributions in a sample market.

The simulation found that:

- The modeled capacity growth plan of the 5G network supports the traffic contribution of both gaming slices and the mobile broadband slice without further capacity expansion and investments.
- Service providers can expect a 4 percent overall service revenue increase by leveraging estimated charges for enhanced 5G connectivity from gaming slices alone by the end of the decade.

The rise of cloud gaming steers growth for service providers

Cloud gaming is changing the content distribution dynamics in the gaming industry. The technology promises affordable ways for gamers to play anywhere, without users continuously purchasing hardware upgrades or expensive games.

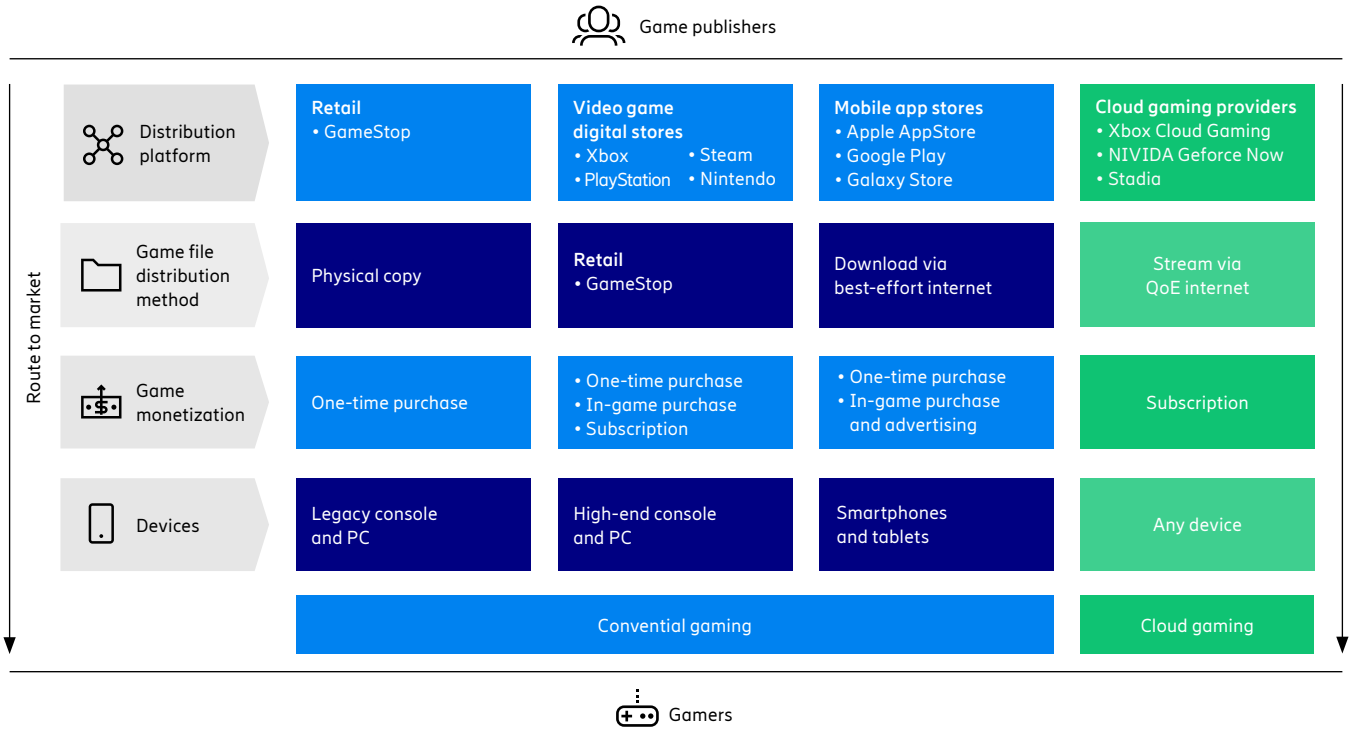
Early adopters praise the advantages offered by cloud gaming, while also demanding their internet providers improve the overall gaming experience. Service providers can leverage the benefits of 5G networks to capitalize on the connectivity needs of this captive and growing market segment in North America.

New cloud gaming technology aims to expand the reach of the gaming industry

Cloud gaming is a revolutionary technology poised to enable gamers to play games on any device via an internet connection with quality of experience (QoE). Gamers will no longer require a physical copy of a game or need to download a digital copy to their consoles, PCs, or smartphones. Instead, for a subscription fee, cloud gaming enables enthusiasts to play games from anywhere, using their current devices, without the need to buy expensive high-end equipment.

Big tech firms and gaming ecosystem players have launched cloud gaming services in recent years, offering gamers new ways to play. The market has reacted positively as 16 percent of gamers say they have recently used a cloud gaming service.[1] Analysts anticipate that cloud gaming growth will continue,[2] expanding the reach to new audiences, including gamers who want to play anywhere and/or do not want to buy high-end devices and expensive video games.

Figure 1: Cloud gaming expands the reach of gaming content distribution



[1] Global Web Index Report, 2020
[2] Global Data, "Cloud Gaming", 2021

Cloud gamers are a growing and captive market for service providers

Despite being a relatively new technology, cloud gaming is expected to reach 15 million subscribers in North America by the end of 2022 and 99 million subscriptions[3] over the next decade, propelled by the following 5 drivers:

Focus on mobile gamers
Major cloud gaming providers are implementing a multi-screen strategy for consoles, PCs, smartphones and tablets. In 2020, Microsoft announced that "the vision for Project xCloud – the cloud gaming service renamed as Xbox Cloud Gaming – is to give gamers the opportunity to play the games they want, with the people they want, anywhere they want."[4] In 2022, NVIDIA GeForce NOW announced the possibility to play popular action games like Fortnite on Android and iOS Safari mobile devices.[5] The intent is to expand the audience beyond traditional PC or console gamers and entice "on-the-go" gamers.

Attractive gaming subscriptions
Major gaming distribution platforms like Xbox, Stadia and PlayStation are bundling cloud gaming into their subscription models to lure gamers and ensure recurring revenues.[6] As a result, gamers benefit from being able to play a broad catalogue of titles anywhere at affordable monthly fees.

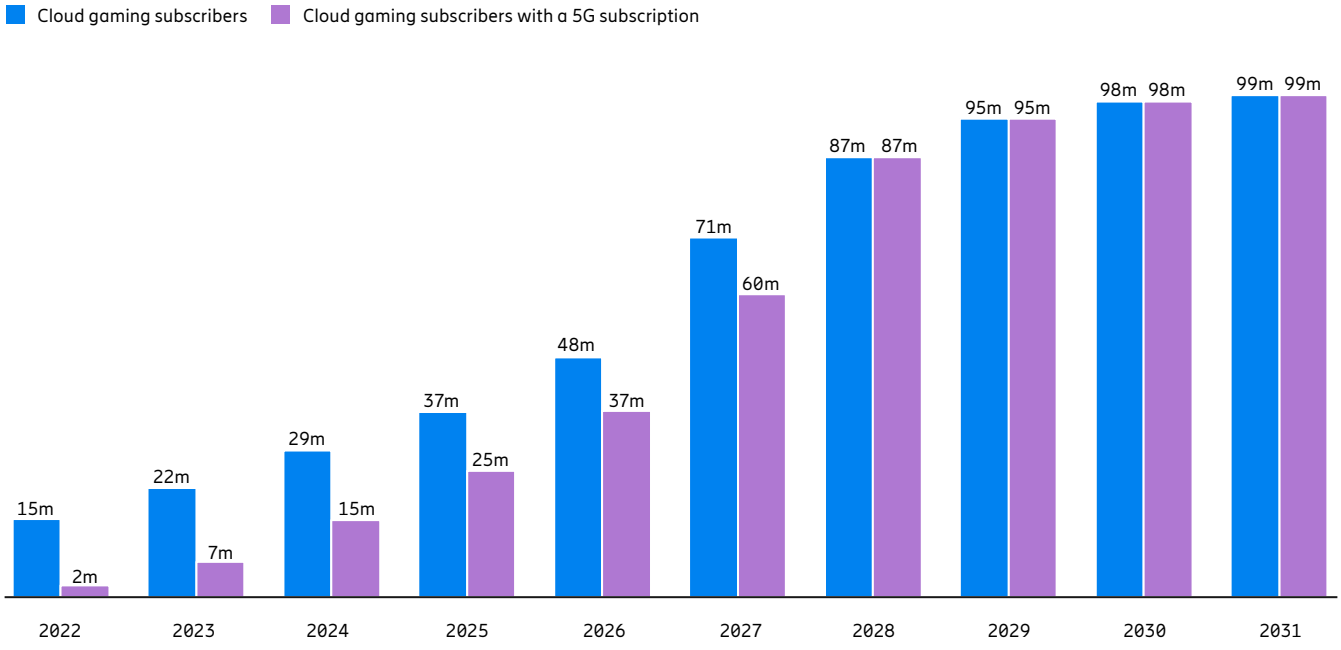
Shift in gamer preferences
Recent trends demonstrate that gamers may shift away from console and PC upgrades as "82 percent of gamers would skip purchasing new gaming hardware in favor of the cloud if connectivity guarantees the performance." [7]

Mature cloud-services ecosystem
A highly mature cloud ecosystem facilitates access to computing resources at the edge of the network to stream games closer to gamers.

Rapid adoption of 5G
Broad network deployments and the availability of devices have enticed mobile subscribers to switch to 5G. Estimates show that 67 percent of cloud gamers will have 5G devices in the next 5 years, growing to 100 percent before the end of the decade.[8]

> "Through the cloud, we're extending the Xbox ecosystem and community to millions of new people, including in global markets where traditional PC and console gaming has long been a challenge."
>
> **Satya Nadella**
> Chief Executive Officer of Microsoft
> Jan 2022 [9]

Figure 2: Cloud gaming subscriber forecast, North America 2022–2031



[3] inCode estimated the number of cloud gaming subscriptions in North America leveraging cloud gaming trends and reports from recognized industry analysts like Omdia and ABI research
[4] xbox.com/en-us/2020/08/04/xbox-game-pass-ultimate-cloud-gaming-on-september-15/
[5] nvidia.com/en-us/geforce-now/fortnite-mobile/
[6] inCode modelled the 5G adoption within cloud gaming subscribers leveraging 5G industry reports like Ericsson Mobility Report
[7] spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/gaming-industry-delves-deeper-into-subscription-offerings-69583544
[8] amdocs.com/sites/default/files/2022-04/US_Cloud_Gaming_Survey_Findings_March_2022_FINAL.pdf inCode modelled the 5G adoption within cloud gaming subscribers leveraging 5G industry reports like Ericsson Mobility Report
[9] microsoft.com/en-us/Investor/events/FY-2022/Microsoft-and-Activision-Blizzard-Conference-Call

Cloud gaming needs networks with guaranteed performance to scale up

For cloud gaming, the promise of delivering seamless and "real-time" gaming experiences comparable to consoles or PCs depends primarily on the quality of the gamers' connectivity. Game content needs to be transferred speedily from the cloud server to the gaming device, and the corresponding gamers' commands need to be sent back to the server just as quickly to generate the next action. However, the quality of existing broadband connectivity underperforms gamers' expectations as "47 percent of gamers indicate that reduced lag is a key connectivity improvement".[10] Therefore, major cloud gaming providers demand stringent broadband performance from internet providers.

For example, Xbox and Stadia request minimum speeds of between 10 and 15Mbps, with other platforms like Antstream and Blacknut requiring around 6Mbps. In addition, cloud gaming needs latencies under 50ms to ensure accurate content display in response to gamer commands without disrupting the experience.[11] The industry expects these minimum speed and latency requirements for gaming to evolve over time.[12] Many cloud gamers will often experience much higher speeds when gaming, but these minimum requirements guarantee the gaming experience is still satisfactory during high network utilization.

5G brings key capabilities for servicing cloud gaming

Service providers have embraced digital transformation to pursue future-proof wireless networks. 5G brings capabilities that will help manage infrastructure more efficiently and serve varied use cases like cloud gaming:

- **Network slicing to guarantee QoE:** The 5G network slicing framework allows for efficient radio resources and spectrum allocation, as well as enabling QoE policies. Advanced software features, such as guaranteed minimum bitrate, help deliver consistent bandwidth even during high traffic hours. Service providers can assign cloud gamers to a differentiated slice every time they start a cloud gaming session on their smartphones to guarantee performance metrics like bandwidth and latency.
- **More flexibility to incorporate edge computing to reduce gaming lag:** 5G enhances edge capabilities to enable workload execution much closer to subscribers, reducing end-to-end latencies. Service providers can reduce the lag time between the gamer commands and subsequent actions.

Reduced lag is considered a key connectivity improvement by 47 percent of North American cloud gamers.

47%

[10] Ribbon, "The Global Telco 5G Cloud Gaming Opportunity", 2021
[11] RootMetrics, "Mobile Cloud Gaming", 2020
[12] GSMA, Cloud AR/VR Whitepaper - Future Networks

Cloud gaming spearheads new 5G revenues for service providers

A fundamental question for service providers is how to monetize their 5G investments by delivering superior experiences. The answer lies in their ability to enable multiple differentiated services that generate new revenue by leveraging these investments.

To help shine a light on how service providers can start to monetize 5G investments with cloud gaming, inCode evaluated cloud gaming segments based on their network performance requirements and their willingness to pay for enhanced connectivity. A simulation of a sample market in North America, that assumed that cloud gamers would be willing to pay between USD 5.49 and USD 10.99 more per month for connectivity that guarantees minimum speeds and low latencies, resulted in 4 percent overall incremental service revenues by the end of the decade.

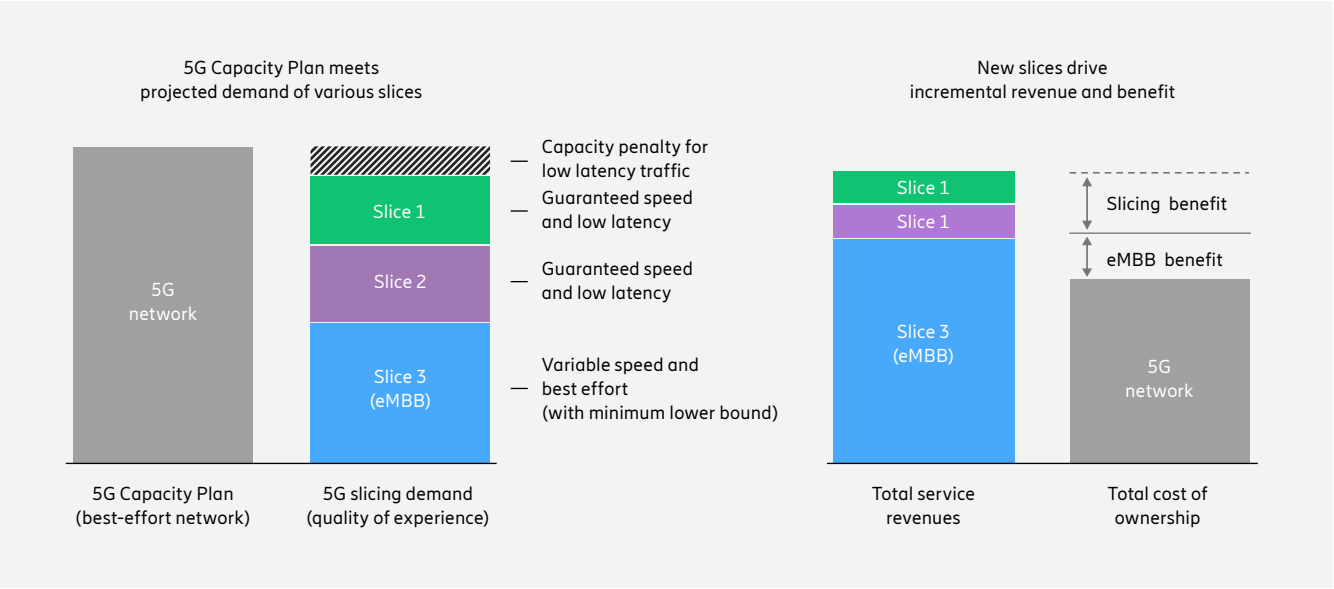
Evaluating 5G network and economics to serve cloud gaming with slices

inCode developed a comprehensive technical and financial model that estimates the capital and operational expenditures to build and operate the 5G sites required, depending on the spectrum band selection, to serve the projected demand over the next few years. The model accounts for end-to-end network deployment – including RAN, standalone core, service orchestration and edge computing.

Furthermore, the model implements three slices, each with specific minimum speeds, latency requirements and traffic contribution in the network's busy hour.

The tool estimates the 5G network planning and investment baseline and simultaneously accommodates two different types of stringent cloud gaming traffic and one type of conventional best-effort enhanced mobile broadband (eMBB) traffic. The model also accounts for a capacity penalty from low-latency traffic which demands more 5G radio resources than comparable best-effort traffic. To preserve the experience of the eMBB slice, the model considers a minimum lower bound to trigger the build out of more sites. Therefore, the model designs the 5G network, estimates required investments, optimizes the use of available capacity to serve cloud gaming with slices, and projects new incremental revenues and benefits.

Figure 3: Evaluating 5G capacity and economics with slices



Two key simulation considerations

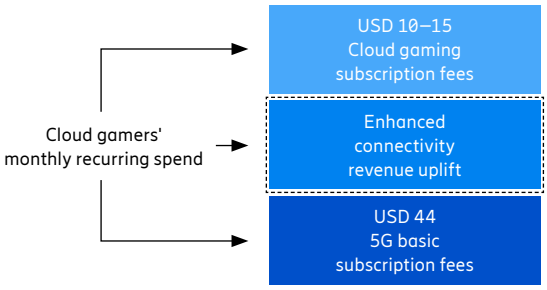
1. Cloud gamers would pay between USD 5.49 and USD 10.99 more for gaming slices

inCode estimates that cloud gamers currently make up approximately 4 percent of the 5G subscriber base but will reach 25 percent over the next decade.[13] However, not all cloud gamers are willing to pay for guaranteed experience. Our analysis of the gaming market trends suggests that almost 80 percent of gamers are willing to pay more for enhanced 5G connectivity on top of the basic monthly bill,[14] which on average is USD 44 per subscriber in the US.[15]

The simulation targeted only half of those willing to pay extra and defined two market segments based on their price sensitivity: one willing to pay USD 10.99 more for an advanced performance gaming slice, and another willing to pay USD 5.49 more for a moderate performance slice, in addition to the 5G basic service. Altogether, the target segments for gaming slices are estimated to reach 10 percent penetration within the 5G subscriber base by 2031.

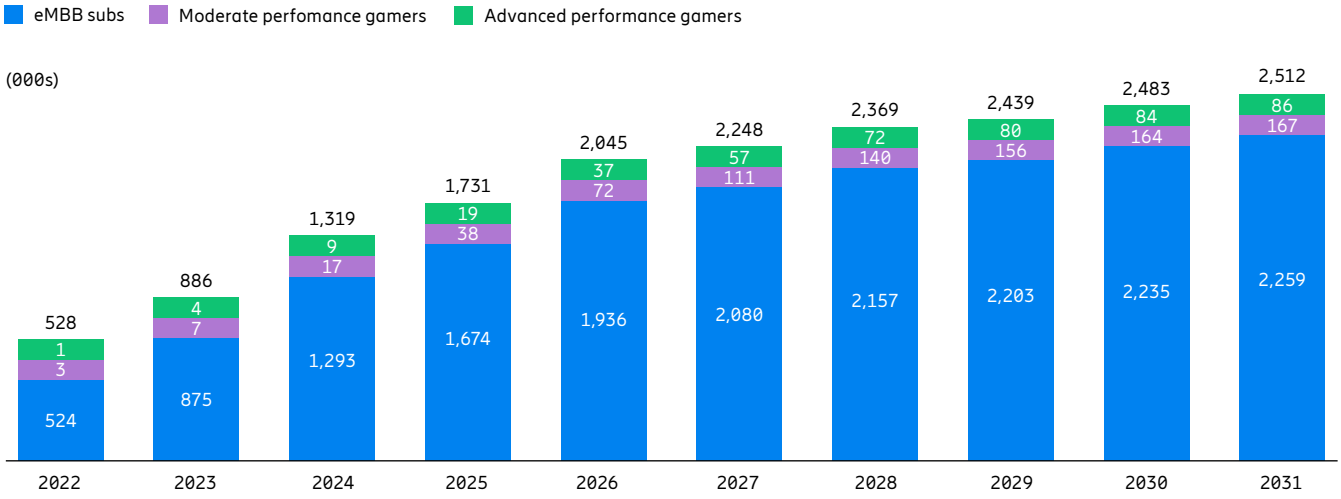
Over the next decade, service providers should consider incremental price increases for enhanced 5G services. For reference, subscription-based platforms have doubled their prices every 7 years, which is equivalent to a 10 percent annual increase.[16] The incremental gaming prices shown examine gamers' willingness to pay for premiums solely for enhanced connectivity and excludes the subscription cost with the cloud gaming provider.

Figure 4A: Target cloud gamer segments, adoption, requirements and incremental revenue



Target segment	Advanced performance gamer		Moderate performance gamer	
Forecast	2022	2031	2022	2031
Cloud gamers (% of 5G subs)	0.1	3.4	0.1	6.6
Minimum guaranteed speeds (Mbps)	15	72	6	28
Monthly ARPU uplift (USD)	10.99	25.99	5.49	12.99

Figure 4B: Gaming slices–subscriber adoption forecast[17]



[13] inCode projected the number of cloud gaming subscriptions within 5G subscribers in North America leveraging cloud gaming trends and reports from recognized industry analysts like Omdia, ABI research and GlobalData

[14] "78% of those gaming subscribers – with both existing broadband and gaming subscription – would pay extra for a traffic prioritization service". Digital Consumer Insights 2021 Analysis: The Gaming Opportunity for Service Providers, Omdia, March 2022

[15] The average cost per 5G subscriber in a shared plan with 4 or more lines is USD 44/sub/mo., Global Data, Sep 2021

[16] Netflix has increased its standard monthly subscription from USD 7.99 in Apr 2013 to USD 15.49 in Jan 2022, representing a CAGR of ~ 8.6 percent over the 8-year period: theverge.com/2022/1/14/22884263/netflix-price-increases-2021-us-canada-all-plans-hd-4k

[17] The adoption forecast is for a sample market as part of the simulation

2. Forecasted 5G capacity growth suffices demand from cloud gaming and mobile broadband

InCode simulated a service-provider-agnostic 5G network using low- and mid-band spectrum in a sample market. We designed the 5G network to serve an initial average monthly data usage per subscriber of 13GB in outdoor spaces, growing yearly at 25 percent over the decade.[17] To meet the requirements of cloud gaming providers, inCode modelled 2 cloud gaming slices with different guaranteed minimum bandwidths: 1 with low minimum bandwidth of 6Mbps (moderate performance slice) and 1 with high minimum bandwidth of 15Mbps (advanced performance slice). Latencies of 25ms between the device and the radio and the annual growth of minimum bandwidths to account for platform evolution were also modelled. A third slice was also modelled to provide best-effort mobile broadband service (eMBB slice) using the available system capacity after serving both gaming slices.

The simulation predicts that the 5G capacity plan meets cloud gaming demand, assuming that gamers on the moderate and advanced performance slices will use approximately two times and eight times, respectively, the projected average monthly data usage per subscriber by 2031 (Figure 5A). Therefore, the simulation results show that the estimated traffic contribution – in busy hour – of each slice can be supported by the 5G capacity growth plan without further expansions (Figure 5B).

Figure 5A: Forecasted average monthly data usage per subscriber

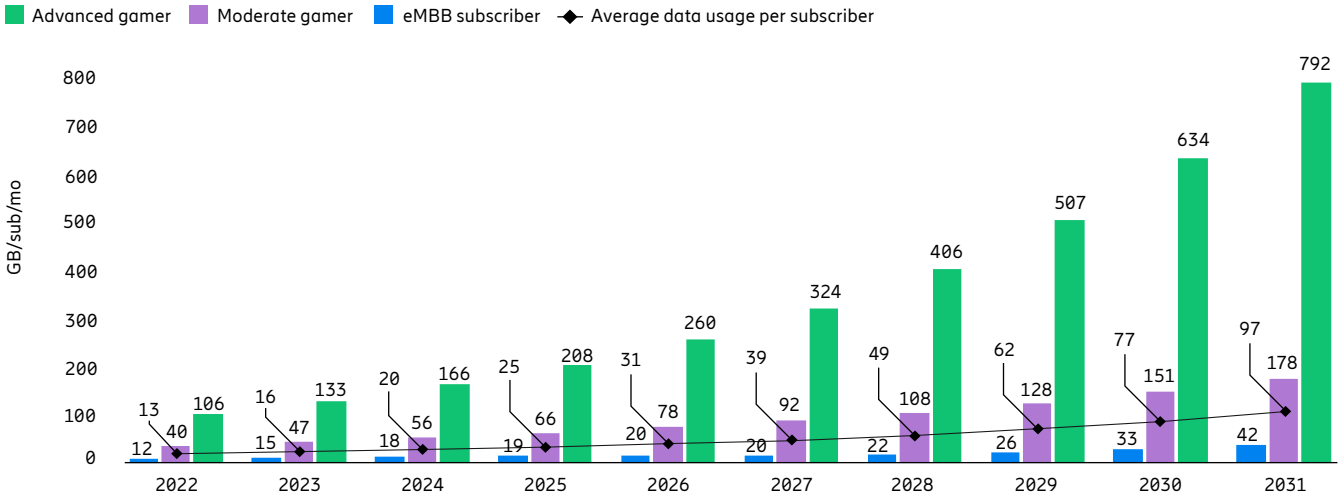
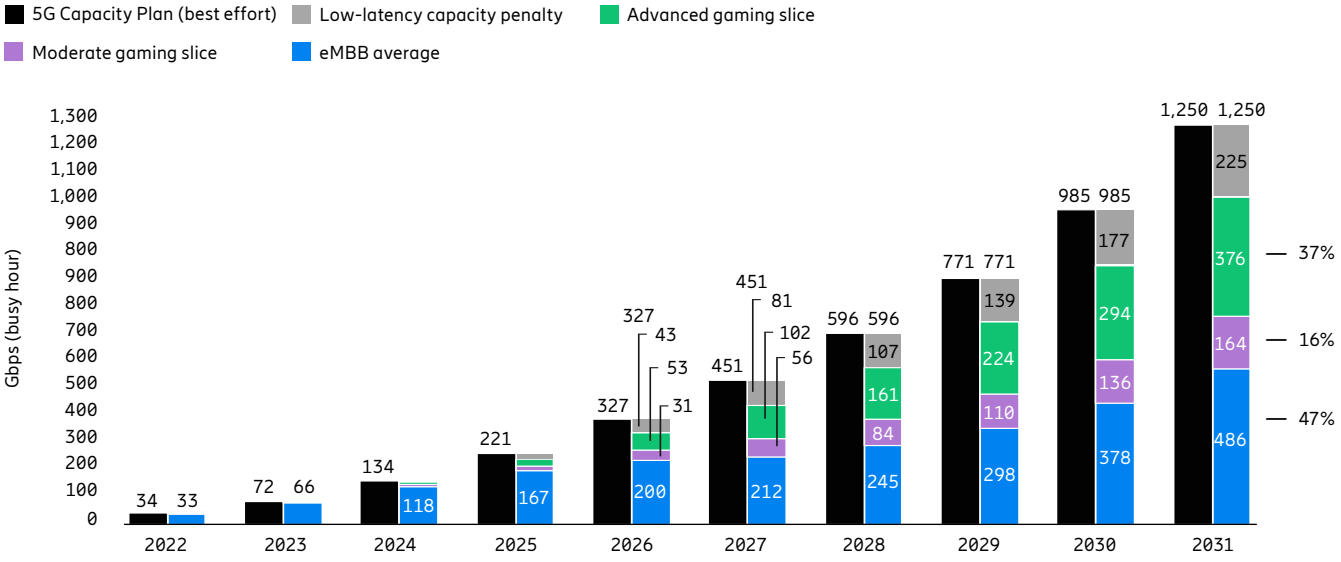


Figure 5B: Served demand in network busy hour, 5G best effort vs 5G with gaming slices

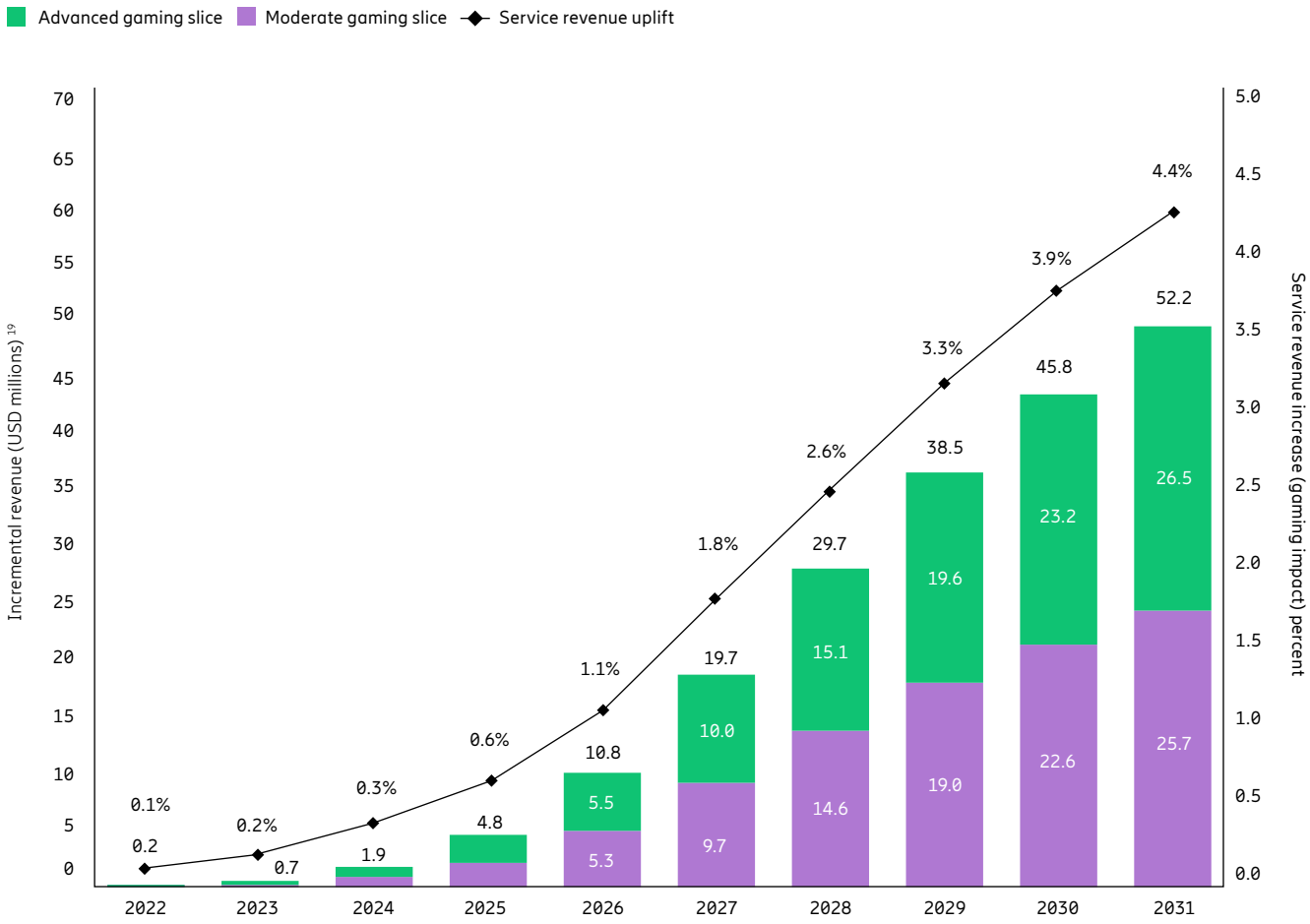


[18] Ericsson Mobility Report Dec 2021, Ericsson Mobility Visualizer

Cloud gaming slices drive 4 percent service revenue increase for service providers

The inCode simulation estimates that service providers can anticipate a 4 percent overall service revenue increase by the end of the decade by leveraging estimated charges from gaming slices. The incremental revenue is driven by the adoption of gaming slices among the two targeted gaming segments. Also, the use of network slices enables service providers to efficiently manage the 5G network capacity – built in line with forecasted data usage growth – and serve the projected cloud gaming demand with planned capacity. More aggressive adoption of cloud gaming slices will require the revaluation of the traffic growth forecast and the 5G capacity plan. As a result, service providers generate new revenues from their planned 5G networks through differentiated services.

Figure 6: Gaming slices incremental revenue vs service revenue increase



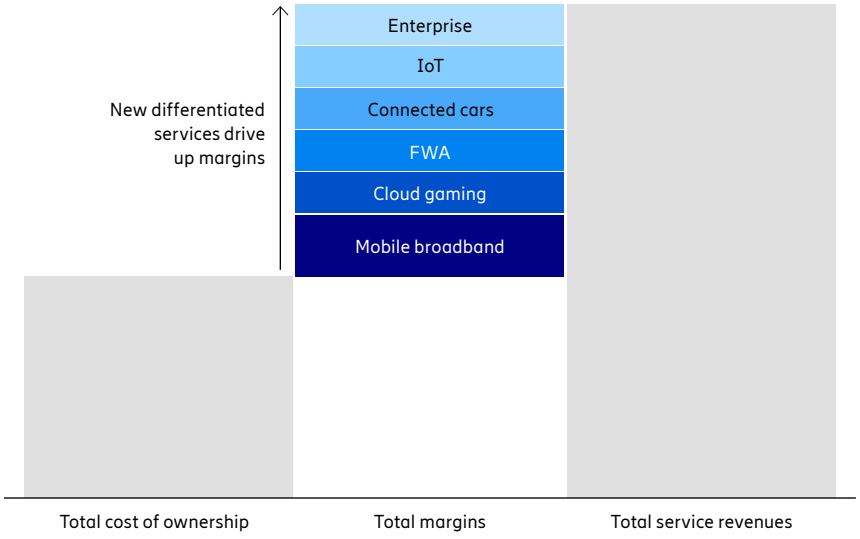
[19] Revenue numbers are for a simulated Tier-1 operator in a sample market

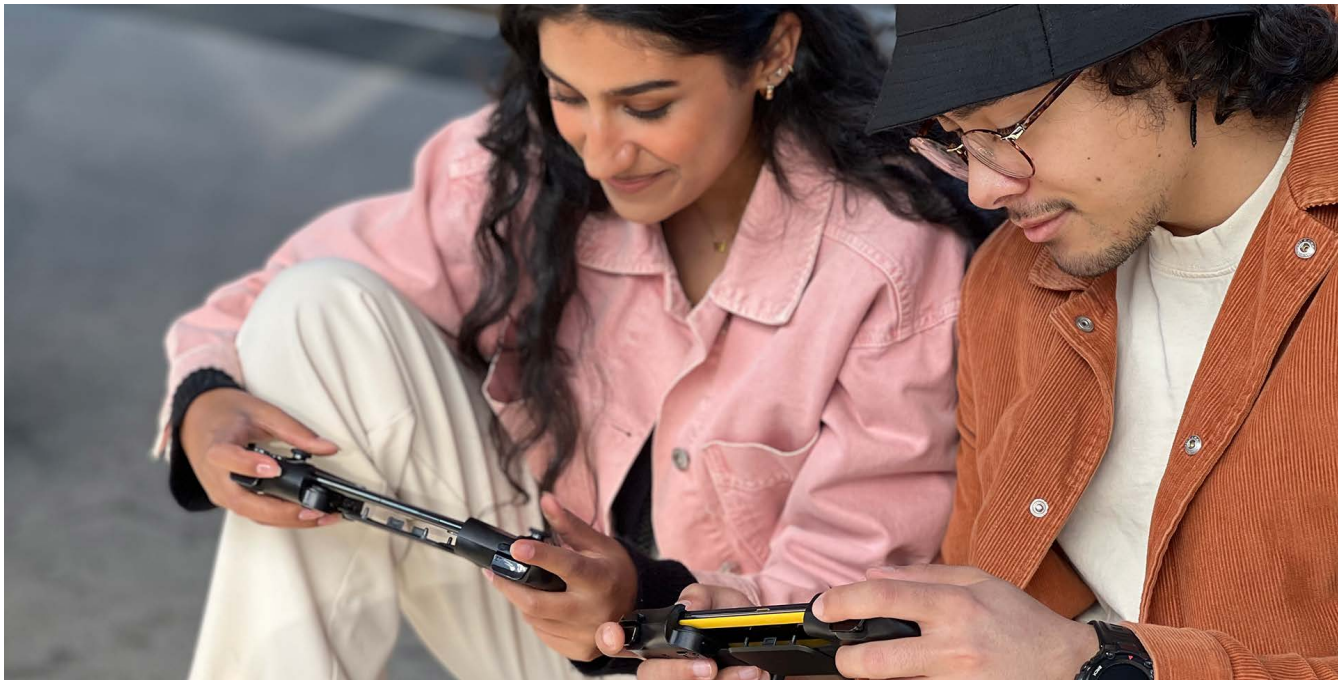
Unlocking the next level on the path to monetizing 5G

Cloud gaming with QoE will soon become a reality thanks to the capabilities of the 5G networks and its service-oriented platform.

Cloud gaming will be one of the first consumer use cases to capitalize on the low latencies and high speeds of 5G networks, driving revenue uplifts to traditional service revenues. However, service providers can extend the technical frameworks of network slicing and digital enablement to deliver more differentiated services for both consumers and enterprises. In the near term, service providers can serve existing and new use cases like fixed wireless access, connected cars, IoT and private networks for multi-traffic profiles with ease of deployment, improved management, and enhanced performance. As a result, service providers will be positioned to bring to the marketplace a variety of use cases at different price points, leveraging their 5G infrastructure and capturing new revenues through a broader set of services for their customers.

Figure 7: 5G multi-service platform economics





About Ericsson

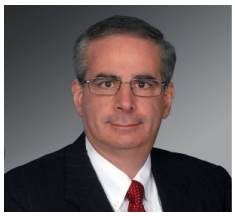
Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

www.ericsson.com

About inCode Consulting

Strategy consulting arm of Ericsson North America that assists investors, vendors, service providers, enterprises and the public sector with strategic growth strategies, technology assessment and financial planning across varied domains such as 5G networks, private wireless networks, fixed wireless, spectrum assessment, fiber, business and operations strategy, and digital and cloud transformation. With decades of expertise serving the telecom industry, inCode can help you answer wide-ranging questions on the business opportunities of 5G networks.

www.incodeconsulting.com

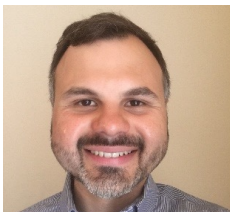


Richard Rosmarin
Head of inCode

Richard has over 30 years of experience across the telecommunications and private equity industries. His extensive expertise on mergers and acquisitions, service provider strategy and operations, and board advisory has helped create billions in incremental enterprise value.

Raj Sonak
Principal

Raj has over 20 years of experience in the telecommunications industry with extensive strategy and technology consulting roles with service providers. He specialises in 5G network evolution, monetization and private wireless networks.



Tomislav Marcinko
Senior Consultant

Tomislav combines 14 years of experience in technical, business development and strategy consulting roles in the telecom industry. He specialises in the market adoption of 5G use cases and 5G networks modeling and business case analysis.

Ericsson
SE-164 80 Stockholm, Sweden
Telephone +46 10 719 0000
www.ericsson.com

123-MANA-22:002856 Uen