Cloud gaming requires 'game ready' 5G networks and industry co-operation

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The idea of cloud gaming has been resurrected after a few failed starts thanks to ubiquitous broadband connectivity and advancements in cloud technology. The new cloud-gaming propositions are promising and the market is developing quickly. New players including Google, Hatch, Nvidia and Shadow are leading the market and incumbent console providers such as Microsoft and Sony are responding to competition to protect their dominance. 5G will be pivotal in this gaming evolution and mobile operators need to understand the technical and commercial implications of cloud gaming. This article analyses the potential impact of cloud gaming on mobile networks, discusses the measures that operators can take to guarantee a high quality of experience (QoE) and highlights the importance of industry partnerships in order to obtain a bigger slice of the commercial opportunity.

Cloud gaming is a compelling use case for 5G

There are currently two main drivers of consumer demand for cloud-gaming services. The first is the democratisation of gaming: cloud gaming reduces the barriers of cost and technology and attracts new and casual gamers into the market. The second is the ability to "game on the go": users can access gaming at any time, on any device and in any place. This will benefit from wireless network technologies such as 5G.

It is likely that a big portion of cloud-gaming traffic will go over fixed and Wi-Fi networks, as is the case for streaming video. However, 5G and fixed-wireless networks are also likely to carry a significant amount of cloud-gaming traffic. For instance, a recent poll conducted by the Mobile Video Industry Council revealed that mobile operators expect 25–50% of their 5G data traffic to come from cloud gaming by 2022.[1] This is perhaps not so surprising, because cloud gaming is already forming part of mobile operators' go-to-market strategies for 5G. As part of these strategies, operators are increasingly forming partnerships with cloud-gaming providers, for example AT&T with Playgiga and Sprint and Vodafone with Hatch. Other operators are launching their own services, such as Deutsche Telekom's MagentaGaming.

How can mobile operators guarantee QoE and subscriber satisfaction for cloud gaming?

Cloud gaming is a type of video streaming in essence because the gameplay elements are encoded, transmitted and streamed just as video frames are. As such, it can be considered to be the next wave of video streaming over mobile networks following OTT video services such as YouTube and Netflix. However, there are some major differences in terms of the quality of service (QoS) and QoE requirements between cloud gaming and OTT video streaming. The most important one is latency. In video streaming, latency is a problem that is only associated with live TV/video services (for example, sports and events) for which the desired latency levels

1 ENEA Openwave Division (2019), Mobile Video Industry Council: cloud gaming could be 25% of 5G data traffic by 2022. Available at: https://owmobility.com/press-releases/mobile-video-industry-council-cloud-gaming-could-be-25-of-5g-data-traffic-by-2022/.

should be in the range of 4–15s. By contrast, latency is measured at the millisecond level in cloud gaming; the maximum latency should be in the range of 80–100ms for a reasonable gaming experience. In fact, serious gamers and competitive multi-player gamers demand even lower latencies (for example, 10–20ms or sub-10ms) because any improvement in latency can translate into a big advantage in gameplay. For mobile networks, such ultra-low levels of latency can only be guaranteed with 5G networks.

Multiple factors affect the cloud-gaming latency such as the encoding, decoding and rendering of cloud-gaming streams and the geographical distance between the cloud-gaming servers and end users. However, operator networks (the last mile) may have the biggest and most unpredictable impact. This is due to a variety of reasons beyond just the type of mobile network technology used. Network congestion and packet loss are big contributors to latency, but these network issues can potentially be alleviated or mitigated by mobile operators. Indeed, a range of technologies and solutions are already available to do so including traffic optimisation and prioritisation, TCP/UDP acceleration and RAN congestion management. Moreover, cloud gaming QoE can benefit greatly from edge computing because of its high sensitivity to server location, as well from network slicing by dedicating latency/QoS-optimised pathways to deliver the cloud-gaming traffic.

One major challenge that operators will face in providing cloud-gaming services is the identification and classification of encrypted traffic. This has also been troubling operators that manage video-streaming traffic. For example, Google Stadia uses encrypted QUIC packets and other providers may adopt encrypted protocols as well. 5G core networks have some embedded identification capabilities, but these may not be sufficient; using additional techniques such as heuristic models and AI/ML capabilities to properly identify, classify, accelerate and prioritise cloud-gaming traffic will be required to ensure low latency and high QoS.

There are other important QoS/QoE management considerations for cloud gaming, including its higher bandwidth and resolution requirements; Stadia is rolling out 4K gaming, for example. In addition, 4G and 5G will co-exist for a long time, and how operators deal with handovers will be important because gamers will demand a similar experience across different access technologies. All of these challenges further highlight the importance for mobile operators to manage and optimise cloud-gaming traffic to ensure high QoE and effective monetisation.

Co-operation between mobile operators, cloud-gaming companies and public cloud providers can facilitate the success of cloud-gaming services

Mobile operators can create new monetisation opportunities through partnerships with cloud-gaming providers. These include offering new service plans such as service bundles, add-ons and zero-rated tariffs. Some operators are going beyond commercial partnerships and are also engaging in technical partnerships. For example, Microsoft partnered with SK Telecom, Vodafone and T-Mobile for its Project xCloud cloud-gaming service to test its performance on live networks and also see to how mobile networks cope with it. This is a win–win proposition for mobile operators and Microsoft because both parties learn a lot about how to deliver the best QoE to their customers.

There is also an increasing number of partnerships between public cloud providers and operators for edge computing. For example, AWS Wavelength partners with KDDI, SK Telecom, Verizon and Vodafone and Microsoft Azure Edge Zones partners with nine operators including AT&T, Telefónica and Telstra. These partnerships allow public cloud providers' cloud stacks to be co-located alongside the operator mobile edge clouds that will run 5G network functions. This will enable gaming developers and gaming-service providers to benefit from these edge cloud locations and the underlying 5G connectivity. We expect to see more of these

collaborations over time as operators continue to adopt edge computing, 5G network exposure capabilities, common APIs and interfaces and shared data assets.