IMDA 5G Use-Case Findings

Levelling up the game play experience with the first 5G mmWave cloud gaming trial in Singapore

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5G enables technologies such as AI, Digital Twin, augmented and The gaming industry is projected to achieve a revenue of US$196 billion by the end of 2022. Supporting this growth is the rise of mobile gaming, where gamers in APAC make up 47% of the global market.

Razer, the world's leading lifestyle brand for gamers, has always been on a mission to bring the world of AAA gaming to the masses, guided by the motto "For Gamers, By Gamers."

Razer has been an advocate for mobile gaming whilst pioneering the cloud gaming experience with a low latency[1] and high bandwidth network. In parallel, essential gaming peripherals like the Razer Kishi mobile gaming controllers provide the much-needed mobile integration that was previously lacking in the market. As a result, this enhances the immersive user experience whilst extending gameplay.

To cope with the growing demand for a more immersive, seamless gaming experience, Razer[2] embarked on a 5G trial with IMDA to push the boundaries of gaming technology. The brand aims to democratise gaming accessibility by looking beyond high-spec PCs that require wired LAN[3] connectivity for gaming purposes. In addition, the 5G trial was focused on the gaming ecosystem and user experience.

"It's about the entire gaming experience and the lifestyle that we want to foster. We are looking at this trial with IMDA from an ecosystem perspective," says Chan Chee Oei, Associate VP, Hardware Engineering (Peripherals), at Razer. "Peripherals are the most immediate ones, but there are other things beyond that, which will take longer to develop."

Ultimately, Razer wanted to test the premise of 5G and how it would support the gaming industry, with games that largely live in the cloud today. In particular, to test the limits of the high bandwidth 5G millimetre wave[4] (mmWave), which run at high frequencies of between 26GHz and 28GHz. The trial also addressed the issue of latency in gaming to improve upon existing 4G LTE technology by roughly 30%.

Simulating a real gaming environment to deliver uninterrupted, high-performance gaming

[1] Latency - Used to indicate delay in data communication over the network.
[2] Razer - An American-Singaporean multinational technology company that designs, develops, and sells consumer electronics, financial services, and gaming hardware
[3] LAN – Local Area Networked
[4] 5G mmWave frequencies – Radio frequency bands above 24GHz and has the fastest 5G speeds

As this was the first ever mmWave trial for Razer, being able to set clear parameters was important as it would pave the way for future exercises of this nature. To mimic an environment that is as close to a real-life gaming event as possible, Razer conducted mmWave trials in two locations, namely at Ngee Ann City, and Singtel Comcentre. The mmWave antennas were placed in these different locations and were tested for throughput, distance and latency, keeping in mind foliage and other tall buildings that surrounded the test sites. Even disruptions to the signal caused by humans walking past, or metal poles around the area were carefully recorded. In one scenario to simulate rain, it was observed that the mmWave experienced 16% of reduction in throughput in the event of bad weather. From the various test cases that simulated the different scenarios, Singtel now has better knowledge on where to deploy the antenna outdoors and indoors to achieve maximum performance.

When Razer embarked on this trial with Singtel[5] in 2019, 5G mmWave technology was still in its infancy in Singapore and around the world. The hardware to support a standalone architecture[6] (SA) was not yet available commercially so Razer conducted the trial on a non-standalone[7] (NSA) architecture. However, despite being fully on an NSA architecture, Razer still managed to achieve their objectives for this trial because the structured approach gave Razer the opportunity to really identify and pinpoint areas of concern. The trial measurements were gathered by running Rohde & Shwartz's cellular measurement test software.

"While Razer has a strong presence globally, we do not have the necessary tools and network in Singapore to conduct holistic research. As such, our collaboration with Singtel was key as the telecommunication conglomerate had the required mmWave base stations specifically for this trial," says Chan. "Conducting the trials in Singapore was preferred as we had mobile network deployment support and expertise for testing with mmWave in a controlled environment, thus giving us the opportunity to focus on gaming with mobile devices."

Re-imagining the mobile gaming experience with 5G-compatible controllers

Razer's product capabilities are consistently challenged by the development of new mobile phone designs. This is because the placement of antennas inside the mobile devices often varies across different brands and models. They are also dynamically active and directionally dependent when it comes to mmWave reception.

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[5] Singtel – A major mobile, fixed, internet and content service provider in Singapore. They are one of the 4 major telcos operating in Singapore

[6] 5G standalone architecture (SA) - 5G deployed on 5G components and it will have 5G core and 5G radio access network

[7] 5G non-standalone architecture (NSA) - 5G Radio access network deployed on existing 4G network core networks and hardware

As mmWave is traditionally used for point-to-point communication, the use case in a gaming environment posed a different set of challenges. The trial provided an opportunity for Razer to find out how controllers affect the performance of mmWave devices when paired together. “Creating a controller that is made to fit over a foreign device has different challenges, as opposed to creating an original device. From this perspective, it was critical for us to understand the characteristics and limitations of the mmWave antenna in this setup,” explains Chan.

Razer needed to build their controllers in a way that can facilitate ease of use and comfort in a gaming environment. At the same time, the choice of material and air gap needed to be perfected so they do not interfere with the phone’s existing mmWave signal reception. “Our controllers are meant to wrap around existing mobile phones that have already been built. As a mobile peripheral manufacturer, we have no control over the antenna placements in the phones, thus the need to scrutinise and understand user implications across a range of different scenarios,” says Chan. How the device is being held to the type of material used, its thickness, and the air gap between the antenna and material, are all paramount to the design of a mobile gaming controller.

With key learnings from this trial, Razer has launched the Razer Kishi V2, a universal mobile gaming controller that promises a “console-class gameplay experience” for smartphones. It also launched the Razer Arctech, a heat-dissipating mobile phone cover that supports the heavy processing load required for a seamless gaming experience.

Paving the way for low-latency and seamless connectivity

When it comes to gaming, having low latency is important, but just as critical to the measure of success is the ability to accommodate multiple players at any time, so that gamers can log on and interact with each other in real-time without affecting the gaming quality. “The ability of 5G to accommodate the heavy load and intense rendering required is what gets gamers excited,” explains Chan, as camaraderie is a big part of the gaming experience.

Particularly for first-person shooter (FPS) games and multiplayer games with high amounts of computer-generated input (CGI), the bandwidth or downlink speed can make or break the experience.

“5G promises a lot from a throughput perspective, where peak mmWave downlink throughput can reach 3.2Gbps. We’ve certainly seen improvements in latency speed from this trial, achieving average latency of sub 10ms, but at this point it’s not significant enough to really make an impact because of the limitations of the NSA architecture. That said, I’m sure this will be different when we proceed with mmWave trials on an SA architecture in the future,” says Chan.

By testing the performance of mmWave in real world settings and applying their knowledge of user gaming behaviours, Razer has the data it needs to support its ongoing R&D efforts. “We are excited to partner Singtel and IMDA again to advance the future of mobile gaming. We are looking at a larger gaming ecosystem play in the near future, with providers across cloud infrastructure, content and end user devices, all collaborating to accelerate APAC’s gaming hub,” says Chan.