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Cloud Gaming on Mobile Devices

For at least a century, the phrase “the right tool for the job” has conveyed a simple yet powerful truth that is well-suited to the emergence of cloud mobile gaming. That is, the tools must deliver the performance, compute and scalability required to meet consumer expectations while being technically feasible and economically viable for the platform. It’s a tall order that some assume cannot be delivered on. Yet a small but very significant group of platforms have found a way.

Migrating from Mobile to Cloud

Rather than stick with the familiar locally run games purchased from native app stores on their iOS and Android devices, proponents of mobile-game-to-mobile-platform (MG2M) ask consumers to run virtual equivalents of the game apps in the cloud. There are very real upsides for mobile game players to MG2M. Games offered on a subscription basis that run in the cloud allow gamers to move from game to game as their preferences change. Cloud-based MG2M gaming enables mobile gamers to seamlessly interact with hundreds or even thousands of others in gameplay, much as game console and PC gamers do. This moves the player from an ownership model to a rental model in the same way that Spotify has done for music and NETFLIX for movies.

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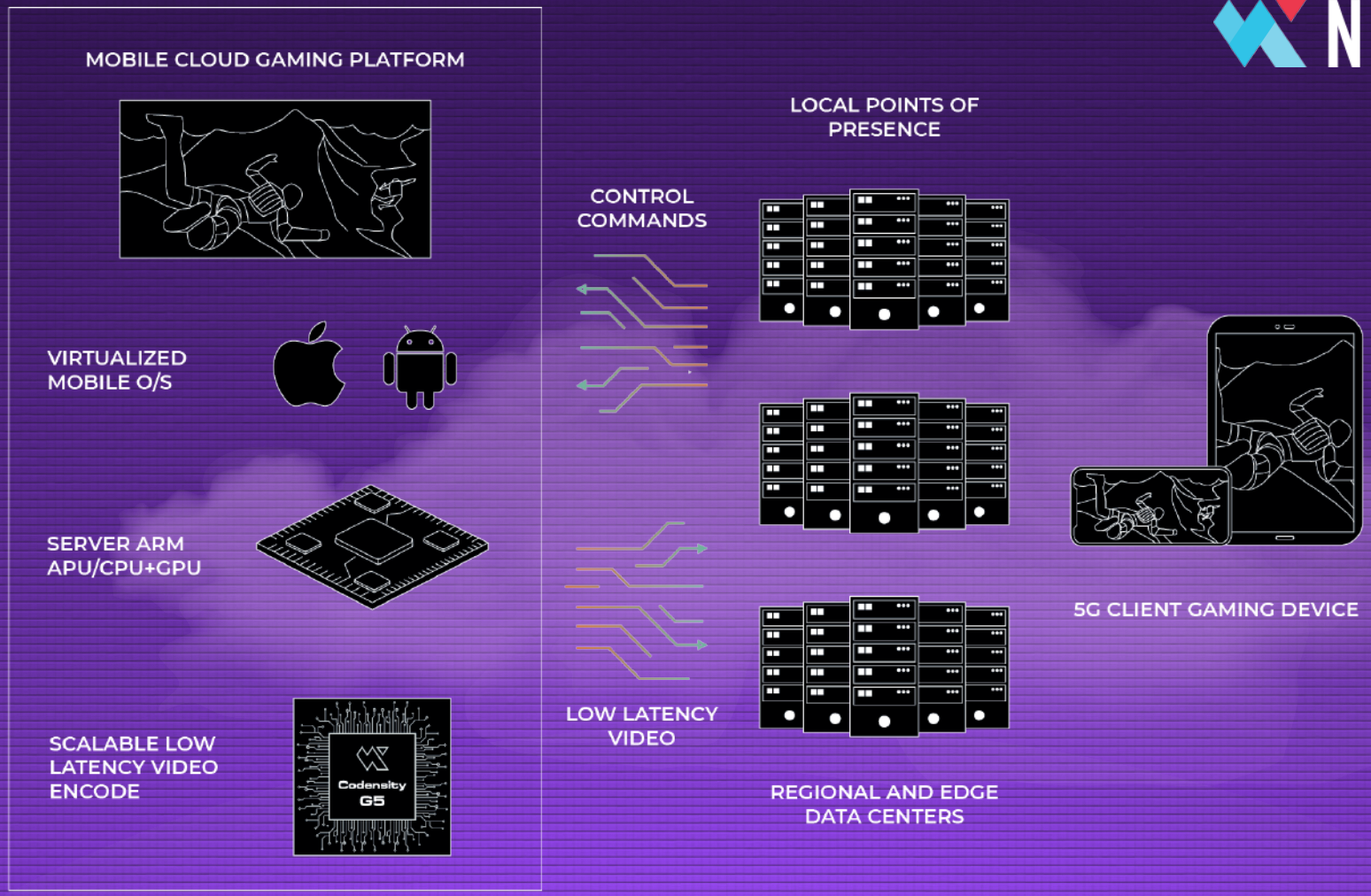

Cloud Gaming for Mobile Devices

To be considered a viable alternative, gamers must be presented the same experience as they would on a native device or app since no one will tolerate a reduction in the quality of graphics, added latency or any other degradation in the gaming experience. As a reference, TIRIAS Research[1] suggests that game player tolerance for motion-to-photon latency on a smartphone, at 30fps, is just two full frames or 70ms. At 60fps, players tolerate four full frames of latency. Meaning, the performance bar is set for cloud-based MG2M services.

[1]https://www.netint.ca/whitepaper-the-emergence-of-cloud-mobile-gaming/

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Motion to Photon Latency Landscape for Cloud Gaming

Latency	Cloud Gaming Use Case
180ms	Maximum for live collaboration with audio
160ms	Maximum for gameplay (latency tolerant games)
90ms	Maximum for high framerate native 60 fps gameplay
80ms	Maximum for high performance native gameplay
40ms	Maximum for high performance, high FPS native gameplay with adaptive sync
30ms	Best available with high performance, high framerate, adaptive sync
20ms	Native low latency pipeline with ultra-low latency VR display

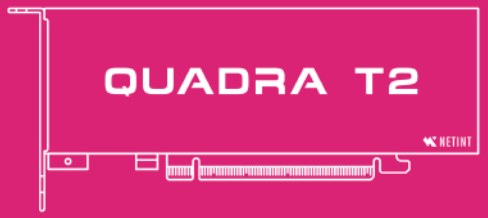
Source: Tirias Research, “The Emergence of Cloud Mobile Gaming”.

There is a profound technical challenge with bringing mobile platforms to commercial success. MG2M platforms that fail to meet gamer expectations will face the swift rejection of gamers and longer-term must concentrate efforts on proving they are worth a second look rather than growing an eager and engaged user base. What's at stake? The estimated $90.5[2] billion in revenue that the mobile gaming market is expected to generate this year.

[2]https://newzoo.com/insights/articles/newzoo-cuts-global-games-forecast-for-2018-to-134-9-billion/

The Right Tools

NETINT Quadra T1 VPU (U.2)



NETINT Quadra T2 VPU (PCIe Card)

These ASIC-based video encoding solutions can deliver a 1080p60 stream at less than 1 watt with a standard resolution ladder up to 8K60. This low power usage enables high-density encoding with up to 10 Quadra VPU's in a 1 RU server.

Using ten Quadra T1 VPU's installed in a single 1 RU server enables real-time encoding of 160 1080p60 streams. What's more, NETINT VPU's deliver the low-latency encoding performance well within the performance expectation of gamers. For example, the encoding latency for 1080p gaming is a mere 8ms with eight concurrent encoded streams at 30fps and four concurrent streams of 60fps. At 720p, it's 4ms for 16-stream 30fps encoding.

At its core, MG2M streams games that are built to run on smartphones and tablets (mobile device architectures). This approach relies on Arm cloud servers designed around (Advanced RISC Machine) Arm processors running virtualized instances of iOS and Android games that otherwise would run natively on mobile processors.

Ampere Computing, Canonical and NETINT Technologies have partnered on such a solution for Android, which is detailed in a recent whitepaper[3]. The solution leverages Ampere's Altra Arm servers, Canonical's Anbox Cloud, which delivers Android apps at scale securely from the cloud to devices, and NETINT's ASIC-based video transcoders.

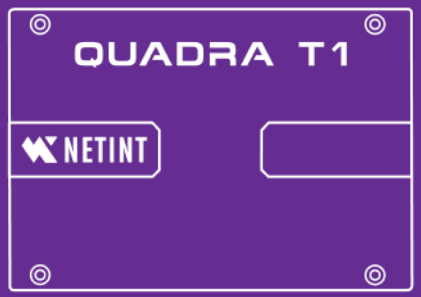
Today's Arm-based designs power the massively multi-core cloud server processors needed for MG2M gaming. Processors with dozens of CPU cores used in combination with GPUs that can run today's mobile apps natively are what make the transition to MG2M possible.

Each gamer session is powered by these GPU's graphics acceleration and ASIC-based low-latency video encoding to offer at least the equivalent of the performance gamers experience playing games natively on their devices. To support the anticipated massive number of MG2M players, server resources must scale on a one-to-one basis with each new gamer session. To reduce network latency, regional data centers—even Multi-Access Edge Computing (MEC) data centers—located close to gamers at play and even closer to wireless service towers are necessary.

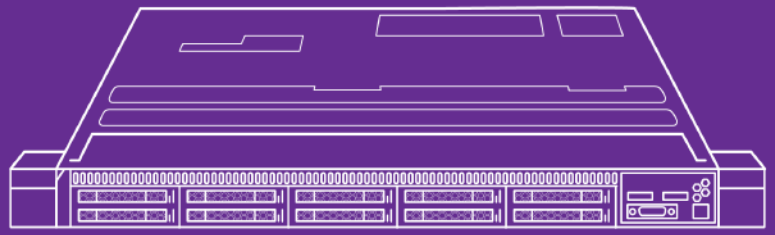
Network latency, however, is simply one reason for lag. Just as Arm-based servers must scale on a one-to-one basis with the addition of each new MG2M gamer, the processors used for ultra-low-latency video encoding must scale on a similar basis. However, the GPU-based video encoders used for 2K and 4K video compression based on state-of-the-art codecs, such as H.265 and AV1, simply are incapable of supporting the gamers' performance expectations for motion-to-photon latency at scale. And though CPU-based software video encoders are exceptionally powerful, the high cost of CPUs at the scale of a successful mobile cloud gaming platform make software encoding prohibitive.

[3]https://netint.ca/whitepaper-canonical-ampere-and-netint-establishvideo-encoding-in-the-cloud-on-arm/?

160 Broadcast Quality 1080p60 Streams in 1RU



10 Quadra T1 U.2 Video Processing Units



1RU NVME Server

NETINT, a pioneer in ASIC-based video encoding technology, is leveraging its Video Processing Unit solutions, available in U.2 and PCIe card form factors, to power the ultra-low-latency encoding required by this demanding server-side approach to mobile gaming. When deployed with Arm-based processors and high-performance GPUs for gaming graphics, NETINT's first and second generation Codensity ASIC's offer the encoding density required to deliver a superior gaming experience to MG2M platform gamers.

NETINT's Quadra line of Codensity-powered video processing units support H.264/AVC, H.265/HEVC, and AV1 codec standards. In addition, Quadra VPUs feature advanced AI capabilities with 2 Deep Neural Network engines each capable of 18 Trillion Operations per Second (TOPS), enabling advanced processing including object detection, classification and segmentation and ROI to provide additional data to the encoding engine for image quality improvement and content adaptive rate control. They are available as PCIe add-in cards and in the U.2 form factor to meet the ultra-high video encoding density needed for cloud based MG2M gaming. To make integration into existing cloud encoding workflows easier, FFmpeg and API software interfaces are available.

Asking gamers to transition away from a familiar app ecosystem where games run natively on their devices will be far more successful if their experiences with MG2M devices equal or surpass what they've grown to expect from years of mobile gameplay.

Delivering that level of experience is now within the reach of service providers due largely to the availability of the right tools for the job. The Arm-based cloud servers, software needed to virtualize game apps in the cloud and the ASIC-based video encoding to enable ultra-low-latency gameplay are now available and clearing the way for service providers to leverage their competitive strengths, particularly subscription model offerings and multi-player gameplay. They also will prove to be essential for service providers wishing to lay claim to their share of the $90.5 billion mobile gaming market.

For more information, please visit our official website at: **www.netint.ca**

Or contact us by E-mail: **info@netint.ca**

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