

Intel® Data Center GPU Flex Series for Windows Cloud Gaming

High density of game streams per server, open cross-platform programmability and a robust software ecosystem make the Intel® Data Center GPU Flex Series the choice for cloud gaming providers.



The fast growth of the global cloud gaming market continues, with a projected CAGR of approximately 42.5% through 2028, when it will have a value of about \$13.3 billion.¹ To compete effectively in this segment, game service providers must continually innovate to deliver first-rate playing experiences to their subscribers while operating the most efficient infrastructure possible.

Remote gaming offers a more cost-effective model than traditional approaches, with key subscriber-retention advantages. At the same time, it creates significant challenges in terms of concurrency, the “last 500 mile” problem, latency and quality of service.

Intel offers solutions, with support for new codecs, new types of bitrate control and low-delay encode, as well as high-concurrency render, capture and encode, with AI-driven resampling. But the benefit doesn't end with cost and latency advantages. The future of cloud gaming offers transformative capabilities that extend to big-world playability and hybrid/split rendering models. Forward-looking makers of gaming engines such as Unity, Unreal and Booming are incorporating these capabilities today.

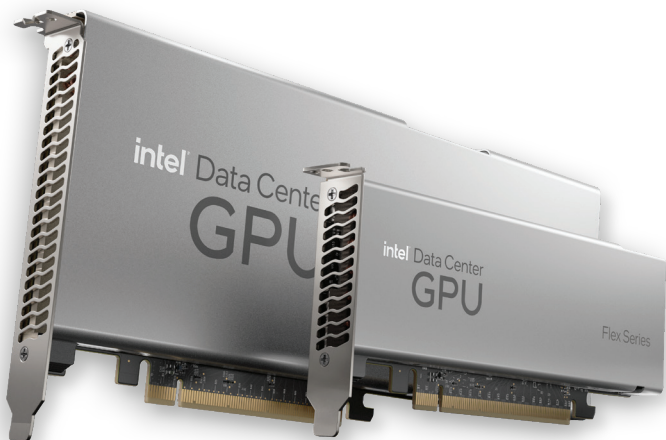


Gamestream, a cloud game streaming solution, allows users to stream and play games on devices with high-end graphics across the entertainment, hospitality, media and telecom markets. Gamestream has been testing their solution on Flex Series with promising results.

“One of our key challenges in cloud gaming is to find the right GPU to increase the overall concurrent users (CCU) number per server, while delivering the best end user experience. We have been pleased to find that Intel Data Center GPU Flex Series 170 offers a high-density, low power solution. During our tests, our reference CCU was improved by 18.76% compared to our current hardware solution. This is a real asset for massive scaling.”²

– Olivier Lebigot, CTO at Gamestream

The Intel Data Center GPU Flex Series provides a standards-based, high-throughput, low-TCO foundation for cloud gaming that helps providers build efficient, effective infrastructure. The platform brings together high gameplay quality with a high density of game instances per server.



Open-Standards GPU Architecture

Code developed for GPUs under proprietary programming models lacks portability to other hardware, creating a siloed development practice that locks organizations into a closed ecosystem. By contrast, the Flex Series GPU supports an open, standards-based software stack together with oneAPI cross-architecture programming for seamless support across CPUs and GPUs.

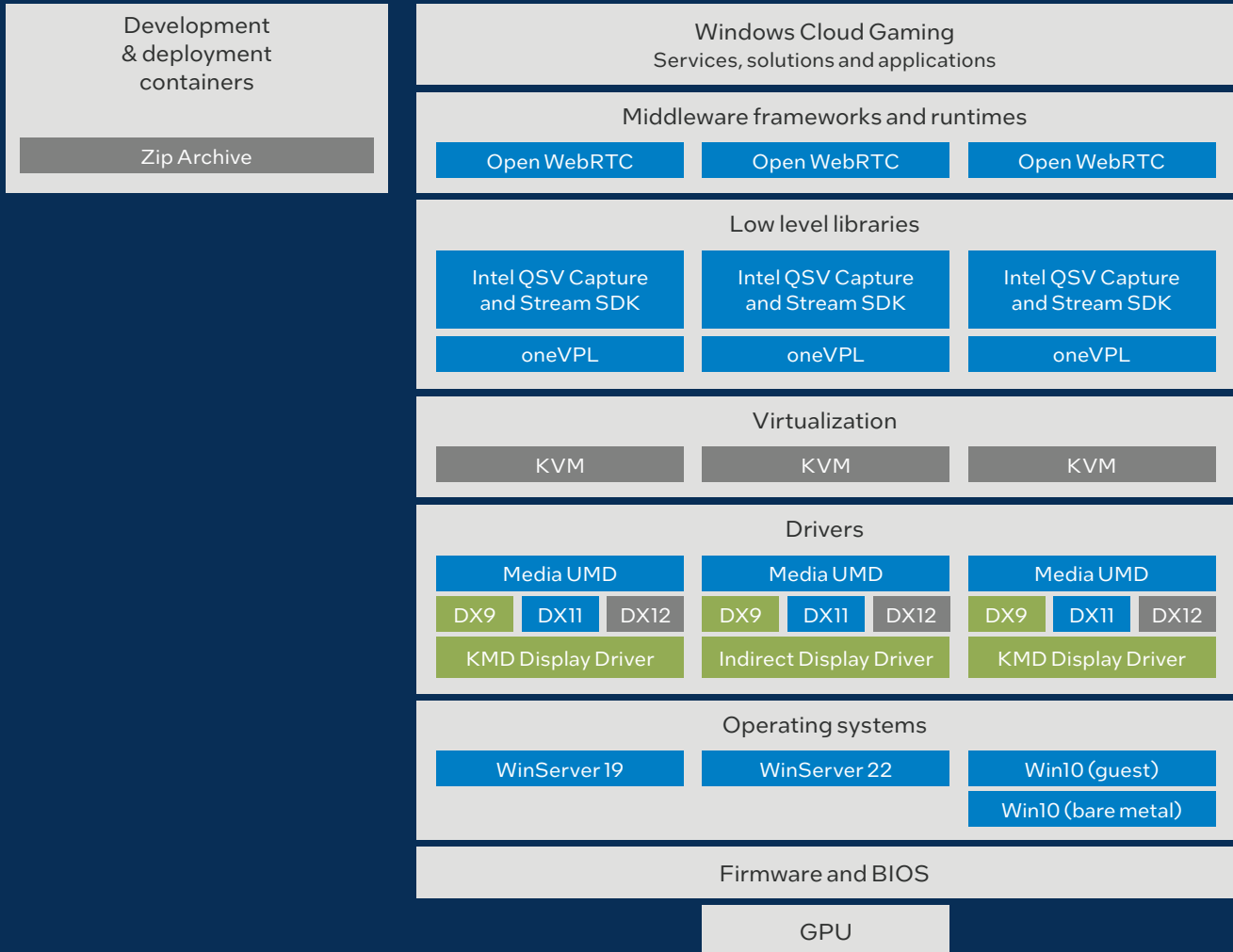
Open standards code development based on oneAPI benefits from a large open ecosystem that includes open source tools, APIs and drivers. That flexibility helps organizations reduce the complexity, cost and time requirements to bring new services and solutions to market, enabling engineers and programmers to innovate instead of maintaining code and easier adoption of new architectures.

WINDOWS CLOUD GAMING SOFTWARE STACK: KEY FEATURES

1080p, 4K support — AVC, HEVC, AV1	Supported
Desktop target capture	Supported
Render target capture DX9, DX11, DX12	Supported
Multi-instance support (render target) DX9, DX11, DX12	Supported
TCAE with WebRTC	Supported
Anti-cheat in virtual instance+ render	Supported for selected titles
Multi-card support	Supported
KMD virtual display support	Supported on 2019 (no SR-IOV)
Indirect Display Driver	Supported on 2022 (single and multi-adapter)
E2E latency automation	Supported
32-bit support	Supported
AV1 support	Supported
DX9 native support	Supported
oneVPL support	Supported
SR-IOV	Supported, covers DX9on12, DX11, DX12
Passthrough	Supported (tested on 2022)

Note: Reflects key features, not an exhaustive list. Please contact your Intel representative for more details.

Windows Cloud Gaming Reference Software Stack



Industry Ecosystem

Extending the benefits of its standards-based open architecture and optimized software stack, the GPU draws on a broad ecosystem of service providers, independent software vendors (ISVs), original equipment manufacturers (OEMs) and others to support a wide range of use cases.

These companies are helping advance the case for powering Windows cloud gaming with servers based on a combined platform of Intel® Xeon® Scalable processors and the Flex Series GPU. The openness and transparency of the programming model also encourages uptake by the open source community, creating a virtuous cycle to further enhance the software stack.

Intel is enabling the software ecosystem to take full advantage of the underlying hardware's capabilities to deliver cloud gaming, including work with software standards, frameworks and vendors.

oneAPI Video Processing Library

The [Intel® oneAPI Video Processing Library \(oneVPL\)](#) provides fast media transcode performance across integrated and discrete GPUs. oneVPL provides a video-focused API for video decoding, encoding and processing in applications spanning media processing and delivery, broadcasting, streaming, video on-demand (VoD), cloud gaming and remote desktop solutions.

Low-level encoder and rate controls provided by oneVPL enable developers to fine-tune encoder configurations to maximize video streaming quality while limiting the impact to gaming frame rates. They can also implement their own rate controls to combine customer domain expertise with Intel hardware innovation. oneVPL is backwards-compatible with Intel® Media SDK core API.³

To optimize delivery of both game content and a customer's internet connection, the Intel Flex Series GPU provides Transport and Content Adaptive Bit Rate Control (TCBRC) and its extension, Transport and Content Adaptive Encode (TCAE). TCBRC provides the best possible quality in an

ultra-low latency, adaptive bitrate control. TCAE builds upon TCBRC to adaptively throttle hardware encode frame size by up to an order of magnitude based on the connection speed and content. TCBRC is supported for the GPU by oneVPL, FFmpeg and GStreamer. Cloud gaming customers benefit from TCAE to connect network feedback to the frame size calculation of TCBRC. oneVPL can be downloaded individually for free.

High-Efficiency Codecs

Even as large-scale data storage has become progressively cheaper, bandwidth to access that data remains expensive. Improved compression enables media processing and delivery providers to reduce those bandwidth requirements, for lower operating costs.

The Alliance for Open Media — a cross-industry consortium founded by Amazon, Cisco, Google, Intel, Microsoft, Mozilla and Netflix — introduced the open source AV1 codec in 2018. This next-generation codec built into the Flex Series GPU brings the highest quality real-time video scalable to any modern device at any bandwidth. It enables delivery of commercial or non-commercial user-generated content with low computational footprint, optimized for internet streaming. In addition to AV1, the GPU also supports existing HEVC and AVC codecs.

Low Latency with a Low Power Envelope

Cloud gaming providers value latency as the prime measure of quality, which is key to outstanding customer experience and retention. The Flex Series GPU supports that objective with innovations such as first-in-industry AV1 support, in conjunction with the flexible performance of Intel Xeon Scalable processors. The GPU is part of an end-to-end gaming architecture, with the platform flexibility of deploying either the Intel Data Center GPU Flex 170 or the Intel Data Center GPU Flex 140.

By supporting more high-quality subscriber sessions per server, the Flex Series GPU enables providers to address growing subscriber bases with smaller data center footprints, helping reduce capital expenditure (CapEx) associated with equipment and facilities costs.

Intel Xe Architecture

Built on the Intel Xe architecture, the GPU has up to 32 Intel Xe-cores and ray tracing units, up to four Xe Media Engines, AI acceleration with Intel® Xe Matrix Extensions (Intel® XMV) and support for hardware-based SR-IOV virtualization and error correction code (ECC) memory.

The Future for Cloud Gaming

The Intel Flex Series GPU offers cloud gaming providers a cost-effective platform for delivering cloud gaming experiences with customer-winning quality. Drawing on the open-standards DNA of Intel architecture, the GPU is code-compatible with Intel CPUs. The open programming environment supports flexible development and removes the inflexible limitations of the proprietary CUDA programming model. With a synergy of hardware and software technologies to drive high-density, high-quality game instances, the Intel Data Center GPU Flex Series will power up gaming providers, leading the industry forward.

With growing Flex Series GPU adoption, Intel's continuous software updates advance workloads for Windows cloud gaming. Enabling customers to realize new capabilities and gains across real-world workloads with 3rd Gen and 4th Gen Intel® Xeon® Scalable processors.

Learn more about the Intel® Data Center GPU Flex Series at www.intel.com/FlexSeriesGPU



¹ Facts & Factors, October 6 2022. "Demand for Global Cloud Gaming Market Size to Surpass USD 13,333.41 Million by 2028, Exhibit a CAGR of 42.50% | Cloud Gaming Industry Trends, Share, Value, Analysis & Forecast Report by Facts & Factors." <https://www.globenewswire.com/en/news-release/2022/10/06/2529877/0/en/Demand-for-Global-Cloud-Gaming-Market-Size-to-Surpass-USD-13-333-41-Million-by-2028-Exhibit-a-CAGR-of-42-50-Cloud-Gaming-Industry-Trends-Share-Value-Analysis-Forecast-Report-by-Fac.html>.

² Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

³ Minor exceptions apply. See Intel, "Upgrading from Intel® Media SDK to Intel® oneAPI Video Processing Library: Transition Guide," <https://www.intel.com/content/www/us/en/develop/documentation/upgrading-from-msdk-to-onevpl/top/developer-details/removed-features-details-and-mitigations.html>.

Performance varies by use, configuration and other factors. Learn more at <https://www.intel.com/PerformanceIndex>.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See configuration disclosure for configuration details. No product or component can be absolutely secure.

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