

AMD FIDELITYFX SUPER RESOLUTION: A REAL GAME CHANGER

INTRODUCTION

PC and console gaming drives graphics innovation like few other applications, but the very pace of technology improvements creates barriers for players and developers alike. Games running in native 4K resolution require powerful and expensive graphics cards and screens with high refresh rates but still can suffer from low frames-per-second (FPS) performance rates and latency problems. Even among enthusiasts, the costs associated with buying the latest hardware usually outweigh the gaming experience, due to the rendering time for such ultra-high-definition environments. But the longer gamers hold on to their systems, the less satisfactory the gaming experience becomes as games incorporate ever richer, more compelling, and immersive environments.

To address this issue, graphics computing providers and game developers created upscaling software, which improves visual acuity by simulating near-native 4K visual quality. It also improves FPS performance and decreases latency. This allows gamers with older hardware to enjoy and experience the latest titles with almost all the visual enhancements, extending the value of their original hardware investment. Problem solved for everybody? Not quite.

Upscaling solutions are complex and have been hard to integrate into games, often leaving visual artifacts such as image ghosting. This has hindered market adoption and limited the number of titles incorporating upscaling. Although developers can create their own upscaling solutions, the market needs an easy-to-implement, off-the-shelf solution that provides full code access to enable customization and optimization across a wide array of hardware. This would allow developers to focus on the creative differentiation of their environments. And, assuming more titles integrate such a solution, it would offer improved gaming experiences for owners of older hardware, lifting sales of new titles and increasing profitability.

In this paper, Moor Insights & Strategy (MI&S) looks at the recently announced AMD FidelityFX Super Resolution (FSR) upscaling technology and explores its claims of improved performance, improved visual acuity, and easier implementation for developers.

FSR CONSUMER BENEFITS

FSR sharpens image edges and enhances texture depth, while, according to AMD, improving FPS performance an average of 2.4x in select games with ray tracing enabled. Resolution settings impact the performance lift. Games with FSR will look and perform better and have lower latency than the same game running on the same hardware without FSR. But that’s just meeting expectations.

FIGURE 1: FSU SUPPORTED HARDWARE

SUPPORTED HARDWARE
SCALABLE SOLUTION THAT WORKS ACROSS
A BROAD SPECTRUM OF PRODUCTS

AMD FidelityFX Super Resolution

FSR WORKING ON	
RADEON™ RX 6000/6000M SERIES	✓
RADEON™ RX 5000/5000M SERIES	✓
RADEON™ RX VEGA SERIES	✓
RADEON™ RX 500 SERIES	✓
RADEON™ RX 480/470/460	✓
RADEON™	✓
RYZEN™ 2000 SERIES PROCESSORS WITH RADEON™ GRAPHICS AND NEWER	✓
NVIDIA® GEFORCE RTX™ 30 SERIES	✓
NVIDIA® GEFORCE RTX™ 20 SERIES	✓
NVIDIA® GEFORCE RTX™ 10/16 SERIES	✓

AMD

Source: AMD

What is surprising is that FSR works across a wide array of older graphics processing units (GPUs) and accelerated processing units (APUs) from AMD, as well as several GPUs from competitor NVIDIA. Some of these products date back to 2016 and are now four generations removed from today’s top-line AMD Radeon RX 6000/6000M series.

Consumers also benefit from FSR as open-source software that runs on Windows, Linux and macOS operating systems, extending its improved gaming experience to as many as possible. FSR’s inclusion in the Xbox GDK means it could support Xbox games; it is also available in a patch for Unreal Engine 4, and Unity integration is available in the [Unity 2021.2 beta](#). As open-source software, FSR is non-proprietary and therefore invites a broader community of developers to join its ecosystem, each able to customize and optimize their games, which in turn drives innovation and rapid improvements.

FIGURE 2: FSR SUPPORTED TITLES AT LAUNCH



Source: AMD

As proof of its comparable ease of implementation, AMD claimed a number of titles at the time it announced FSR in June 2021 and saw an increase of 57% in the succeeding four weeks – with [more to come](#).

FSR DEVELOPER BENEFITS

As mentioned, developers found previous upscaling solutions difficult to integrate, which slowed adoption. FSR’s value proposition for developers, however, is both straightforward and comprehensive.

- **Resolution.** FSR offers four different quality resolution modes: Ultra Quality, Quality, Balanced and Performance. While it improves FPS and image quality in all modes, the impact on FPS performance is most noticeable in the Balanced and Performance settings.

TABLE 1: FSR RESOLUTIONS

FSR QUALITY MODE	SCALE FACTOR	INPUT RESOLUTION FOR 1440P FSR	INPUT RESOLUTION FOR 4K FSR
Ultra Quality	1.3X per dimension	1970 x 1108	2954 x 1662
Quality	1.5X per dimension	1706 x 960	2560 x 1440
Balanced	1.7X per dimension	1506 x 847	2259 x 1270
Performance	2.0X per dimension	1280 x 720	1920 x 1080

Source: AMD

- **Cross-Platform.** As noted, FSR runs on a wide array of GPUs and includes integrations for Unreal Engine 4, Unity and the Xbox GDK.
- **Easy to Integrate.** FSR provides full shader source code with wide support for DirectX12, Direct X11 and Vulkan application programming interfaces (APIs) and can be ported onto multiple platforms without restrictions. It can be integrated through a single compute shader solution without external dependencies, does not require temporal data or per-game training and supports both fixed and dynamic resolution scaling if supported by that game.
- **Open Source.** FSR is available on AMD's open-source tools platform, GPUOpen, under an MIT license.

For those studios that have worked with FSR, this value proposition elicited impressive support.

"Implementing AMD FidelityFX Super Resolution into *The Riftbreaker* was one of the smoothest technological integrations that we have ever done," said Pawel Lekki, chief operating officer of Exor Studios.

Although supporting launch quotes are often hyperbole, such testimony lends credence to AMD's commitment to work with developers to see rapid adoption in other titles.

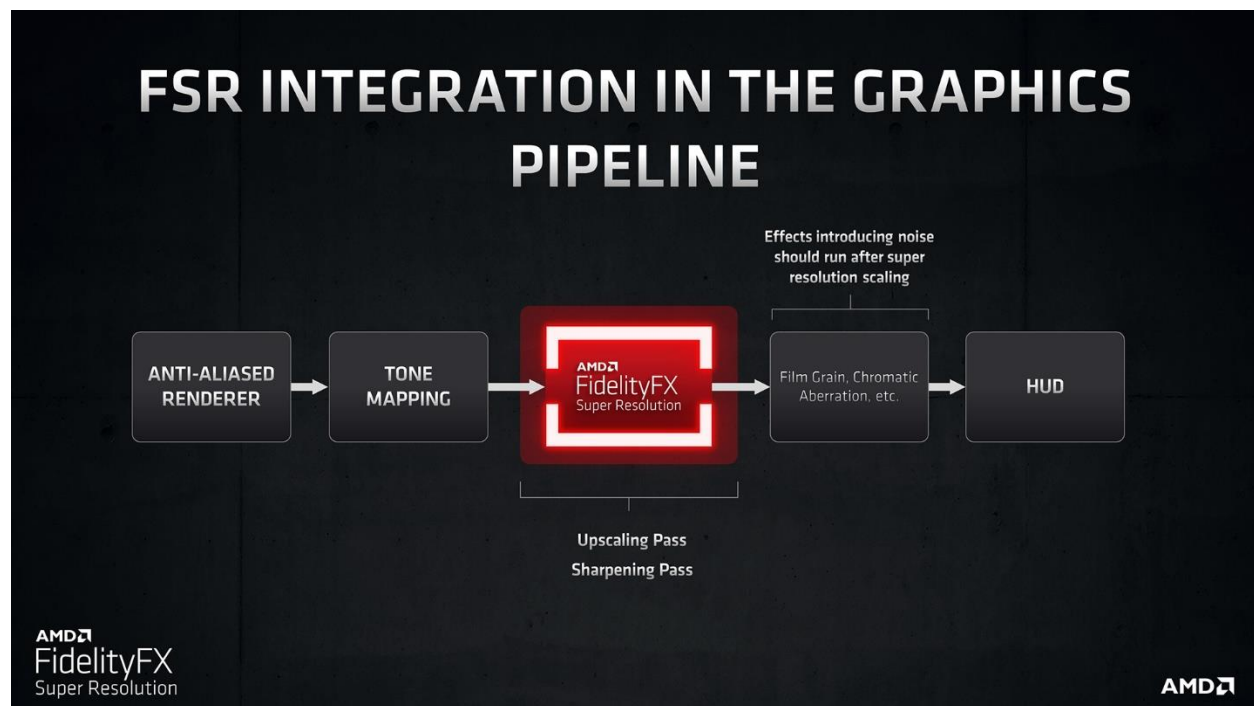
HOW FSR WORKS

FSR is a spatial upscaler, an algorithm that combines Edge Adaptive Spatial Upsampling (EASU) with Robust Contrast-Adaptive Sharpening (RCAS) to reveal greater detail in rendered environments by recreating sharper edges from source images. It upscales the current anti-aliased frame to display resolution without frame

history or motion vector data. The four preset quality modes determine the amount of scaling applied to the source image.

However, FSR may be used without the parameters defined by the four preset modes and supports any area scale factor from 1x to 4x. AMD refers to this as the “arbitrary mode.” It offers developers Dynamic Resolution Scaling (DRS) for situations where a fixed performance budget determines source resolution to maintain a minimum frame rate.

FIGURE 3: THE GRAPHICS PIPELINE



Source: AMD

In terms of the graphics processing pipeline, FSR should be integrated after tone mapping. The EASU and RCAS passes work best in the perceptual color space. Developers should render high-frequency visual and other noise-producing scene components after the FSR upscaling passes to avoid amplification.

CONCLUSION

MI&S believes AMD FidelityFX Super Resolution meets the demand for improved performance in ultra-high-definition gaming and improves image quality to deliver a more immersive gaming experience with less latency. It expands this benefit to an

unprecedented number of older GPUs and APUs – even some from its competitor – to improve the gaming experience for many. This validates AMD’s claim of extending the lifespan and value of consumers’ previous investments in hardware and games.

FSR also largely overcomes the barrier to widespread integration into gaming titles – the complexity problem – with an off-the-shelf, open-source code integrated through a single compute shader solution without external dependencies. Plus, it is cross-platform and supports industry-standard APIs familiar to developers. This ease of implementation is already reflected in its game engine support and bodes well for rapid adoption by developers.

Based on the data we’ve seen, MI&S believes AMD’s FSR, like its FreeSync technology, is likely to have a major impact on the market. We encourage both gamers and developers to consider the visual and performance benefits of this new technology.

For more information: <https://gpuopen.com/fidelityfx-superresolution/>

IMPORTANT INFORMATION ABOUT THIS PAPER

CONTRIBUTORS

[Patrick Moorhead](#), Founder, President, & Principal Analyst at [Moor Insights & Strategy](#)
Zane Pickett, Contributor

PUBLISHER

[Patrick Moorhead](#), Founder, President, & Principal Analyst at [Moor Insights & Strategy](#)

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