Graphics Processing Unit

Graphics processing technology has evolved to deliver unique benefits in the world of computing. The latest graphics processing units (GPUs) unlock new possibilities in gaming, content creation, machine learning, and more.

What Does a GPU Do?

The graphics processing unit, or GPU, has become one of the most important types of computing technology, both for personal and business computing. Designed for parallel processing, the GPU is used in a wide range of applications, including graphics and video rendering. Although they're best known for their capabilities in gaming, GPUs are becoming more popular for use in creative production and artificial intelligence (AI).

GPUs were originally designed to accelerate the rendering of 3D graphics. Over time, they became more flexible and programmable, enhancing their capabilities. This allowed graphics programmers to create more interesting visual effects and realistic scenes with advanced lighting and shadowing techniques. Other developers also began to tap the power of GPUs to dramatically accelerate additional workloads in high performance computing (HPC), deep learning, and more.

GPU and CPU: Working Together

The GPU evolved as a complement to its close cousin, the CPU (central processing unit). While CPUs have continued to deliver performance increases through architectural innovations, faster clock speeds, and the addition of cores, GPUs are specifically designed to accelerate computer graphics workloads. When shopping for a system, it can be helpful to know the role of the CPU vs. GPU so you can make the most of both.

GPU vs. Graphics Card: What's the Difference?

While the terms GPU and graphics card (or video card) are often used interchangeably, there is a subtle distinction between these terms. Much like a motherboard contains a CPU, a graphics card refers to an add-in board that incorporates the GPU. This board also includes the raft of components required to both allow the GPU to function and connect to the rest of the system.

GPUs come in two basic types: integrated and discrete. An integrated GPU does not come on its own separate card at all and is instead embedded

alongside the CPU. A discrete GPU is a distinct chip that is mounted on its own circuit board and is typically attached to a PCI Express slot.

Integrated Graphics Processing Unit

The majority of GPUs on the market are actually integrated graphics. So, what are integrated graphics and how does it work in your computer? A CPU that comes with a fully integrated GPU on its motherboard allows for thinner and lighter systems, reduced power consumption, and lower system costs.

Intel® Graphics Technology, which includes Intel® Arc™ and Intel® Iris® X^e graphics, is at the forefront of integrated graphics technology. With Intel® Graphics, users can experience immersive graphics in systems that run cooler and deliver long battery life.

Discrete Graphics Processing Unit

Many computing applications can run well with integrated GPUs. However, for more resource-intensive applications with extensive performance demands, a discrete GPU (sometimes called a dedicated graphics card) is better suited to the job.

These GPUs add processing power at the cost of additional energy consumption and heat creation. Discrete GPUs generally require dedicated cooling for maximum performance.

Today's GPUs are more programmable than ever before, allowing a broad range of applications that go beyond traditional graphics rendering.

What Are GPUs Used For?

Two decades ago, GPUs were used primarily to accelerate real-time 3D graphics applications, such as games. However, as the 21st century began, computer scientists realized that GPUs had the potential to solve some of the world's most difficult computing problems.

This realization gave rise to the general purpose GPU era. Now, graphics technology is applied more extensively to an increasingly wide set of problems. Today's GPUs are more programmable than ever before, affording them the flexibility to accelerate a broad range of applications that go well beyond traditional graphics rendering.

GPUs for Gaming

Video games have become more computationally intensive, with hyperrealistic graphics and vast, complicated in-game worlds. With advanced display technologies, such as 4K screens and high refresh rates, along with the rise of virtual reality gaming, demands on graphics processing are growing fast. GPUs are capable of rendering graphics in both 2D and 3D. With better graphics performance, games can be played at higher resolution, at faster frame rates, or both.

GPUs for Video Editing and Content Creation

For years, video editors, graphic designers, and other creative professionals have struggled with long rendering times that tied up computing resources and stifled creative flow. Now, the parallel processing offered by GPUs makes it faster and easier to render video and graphics in higher-definition formats.

When it comes to performance, Intel provides no-compromise solutions for both the CPU and GPU. With Intel® Iris® Xe graphics, gamers and content creators can now get even better performance and new capabilities. Optimized for 11th Gen Intel® Core™ processors and perfect for Ultra-thin and light laptops, Intel® Iris® Xe graphics come integrated with the processor. Select laptops also include Intel® Iris® Xe MAX, Intel's first discrete graphics product in 20 years.

Intel® Iris® Xe MAX was designed to provide advanced graphics performance and media capabilities, as well as enjoy seamless, immersive gameplay anywhere in 1080p. All while on a sleek lightweight laptop. Additionally, by combing 11th Gen Intel® Core™ processors, Iris® Xe MAX discrete graphics, and Intel® Deep Link Technology, you can experience 1.4X AI[1] performance and 2X better performance encoding single stream videos[2] than with a 3rd party discrete graphics.[3]

GPU for Machine Learning

Some of the most exciting applications for GPU technology involve AI and machine learning. Because GPUs incorporate an extraordinary amount of computational capability, they can deliver incredible acceleration in workloads that take advantage of the highly parallel nature of GPUs, such as image recognition. Many of today's deep learning technologies rely on GPUs working in conjunction with CPUs.

FPGA vs. GPU for Deep Learning ›

Intel® GPU Technologies

Intel has long been a leader in graphics processing technology, especially when it comes to PCs. Most recently, the Intel® Iris® Xe graphics and Intel® UHD Graphics that are integrated into our 11th Gen Intel® Core™ processors support 4K HDR, 1080p gaming, and other rich visual experiences.

For laptop users, Intel also offers the Intel® Iris® Xe MAX graphics. With our first discrete GPU for PCs based on Intel Xe architecture, you get even more performance and new capabilities for enhanced content creation and gaming.

GPUs in the Data Center

In the data center, Intel supports amazing visual experiences with integrated graphics in Intel® Xeon® processors.

Intel also offers a discrete option with the Intel® Server GPU. This general-purpose GPU is based on Intel® Xe Architecture, and designed to expand exponentially to provide a high-density, low-latency experience in mobile cloud gaming, media streaming, and video encoding.