Apple introduces M4 Pro and M4 Max

M4 Pro and M4 Max join M4 to form the most advanced family of chips ever built for a personal computer.

Figure 1: Logos for the M4 family of chips.

The M4 family of chips is the most advanced lineup of chips ever built for a personal computer.

CUPERTINO, CALIFORNIA Apple today announced M4 Pro and M4 Max, two new chips that —along with M4 —bring far more power-efficient performance and advanced capabilities to the Mac. All three chips are built using industry-leading, second-generation 3-nanometer technology, which improves performance and power efficiency. The CPUs across the M4 family feature the world's fastest CPU core, delivering the industry's best single-threaded performance, and dramatically faster multithreaded performance.1 The GPUs build on the breakthrough graphics architecture introduced in the previous generation, with faster cores and a 2x faster ray-tracing engine. M4 Pro and M4 Max enable Thunderbolt 5 for the Mac for the first time, and unified memory bandwidth is greatly increased —up to 75 percent. Combined with a Neural Engine that's up to 2x faster than the previous generation and enhanced machine learning (ML) accelerators in the CPUs, the M4 family of chips brings incredible performance for pro and AI workloads. And they deliver blazing performance for Apple Intelligence, the personal intelligence system that transforms how users work, communicate, and express themselves, while protecting their privacy.

"Apple silicon has taken the Mac to unprecedented heights, and the rapid pace of innovation continues with M4 Pro and M4 Max,"said Johny Srouji, Apple's senior vice president of Hardware Technologies. "With the world's fastest CPU core, immensely more powerful GPUs, and the fastest Neural Engine ever, the power-efficient performance and capabilities of the M4 family extend its lead as the most advanced lineup of chips in the industry."

M4: Phenomenal Performance and New Capabilities

For entrepreneurs, students, creators, and more, the phenomenal performance of M4 comes to Mac for the first time. M4 features an up to 10-core CPU, with four performance cores and up to six efficiency cores. It's up to 1.8x faster than M1, so multitasking across apps like Safari and Excel is lightning fast. A 10-core

GPU provides incredible graphics performance, up to 2x faster than M1, making everything from editing photos to AAA gameplay exceptionally fast and smooth. And the faster 16-core Neural Engine is great for Apple Intelligence features like Writing Tools and other AI workloads.
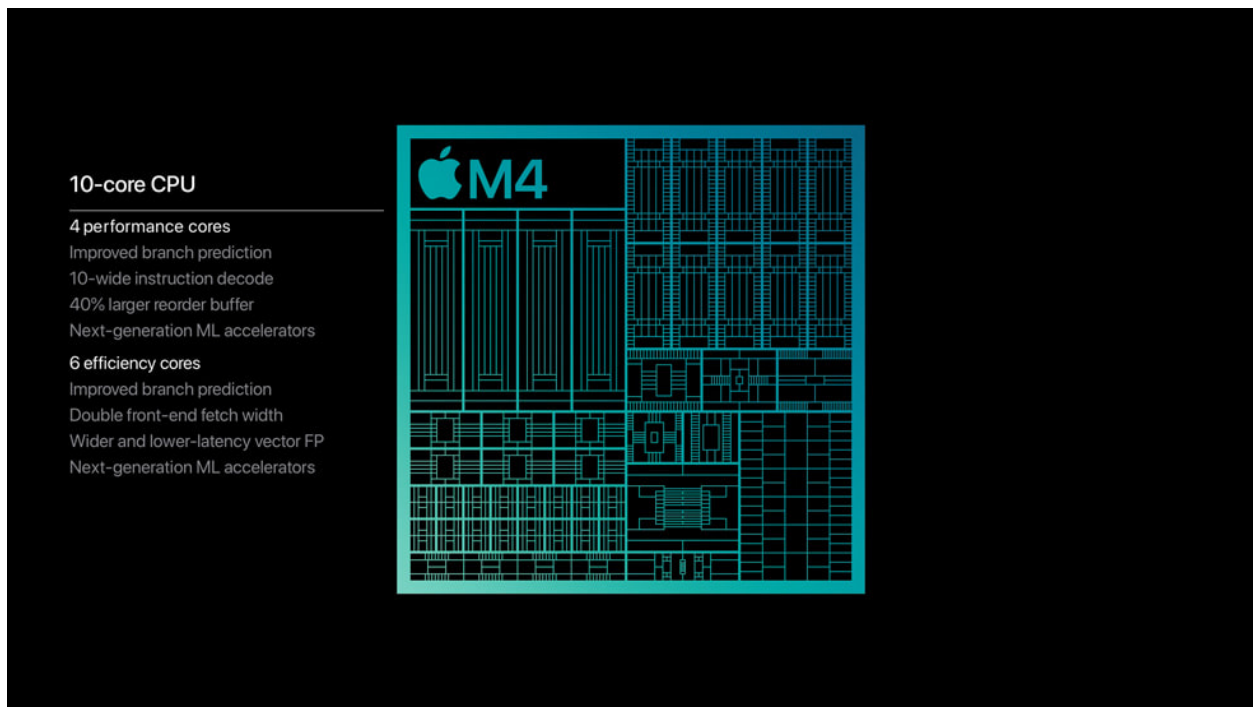

Figure 2: A graphic shows the M4 chip's 10-core CPU, with four performance cores and six efficiency cores.

M4 has a 10-core CPU featuring the world's fastest CPU core and next-generation machine learning accelerators.

The M4 GPU builds on the breakthrough architecture of the previous generation, with faster cores and a 2x faster ray-tracing engine.

M4 supports up to 32GB of unified memory and has higher memory bandwidth of 120GB/s. The display engine of the M4 family is enhanced to support two external displays in addition to a built-in display. And M4 now supports up to four Thunderbolt 4 ports, providing fast data transfer speeds and even more flexibility across peripherals.

The display engine of M4 is enhanced to support two external displays in addition to a built-in display.

M4 Pro: Far More Powerful and Capable than Any AI PC Chip

M4 Pro takes the advanced technologies debuted in M4 and scales them up for researchers, developers, engineers, creative pros, and other users with more demanding workflows. M4 Pro features an up to 14-core CPU consisting of up to 10 performance cores and four efficiency cores. It's up to 1.9x faster than the CPU of M1 Pro, and up to 2.1x faster than the latest AI PC chip.2 The GPU features up to 20 cores for graphics performance that is 2x that of M4, and up to 2.4x faster than the latest AI PC chip.2 This huge boost in performance makes building and testing apps across multiple simulators in Xcode quicker than ever. And with the improved hardware-accelerated ray-tracing engine in the M4 family GPU, games like Control look more compelling, and pro 3D renderers can produce stunning imagery in even less time.

The 14-core CPU of M4 Pro is up to 1.9x faster than the CPU of M1 Pro, and up to 2.1x faster than the latest AI PC chip.
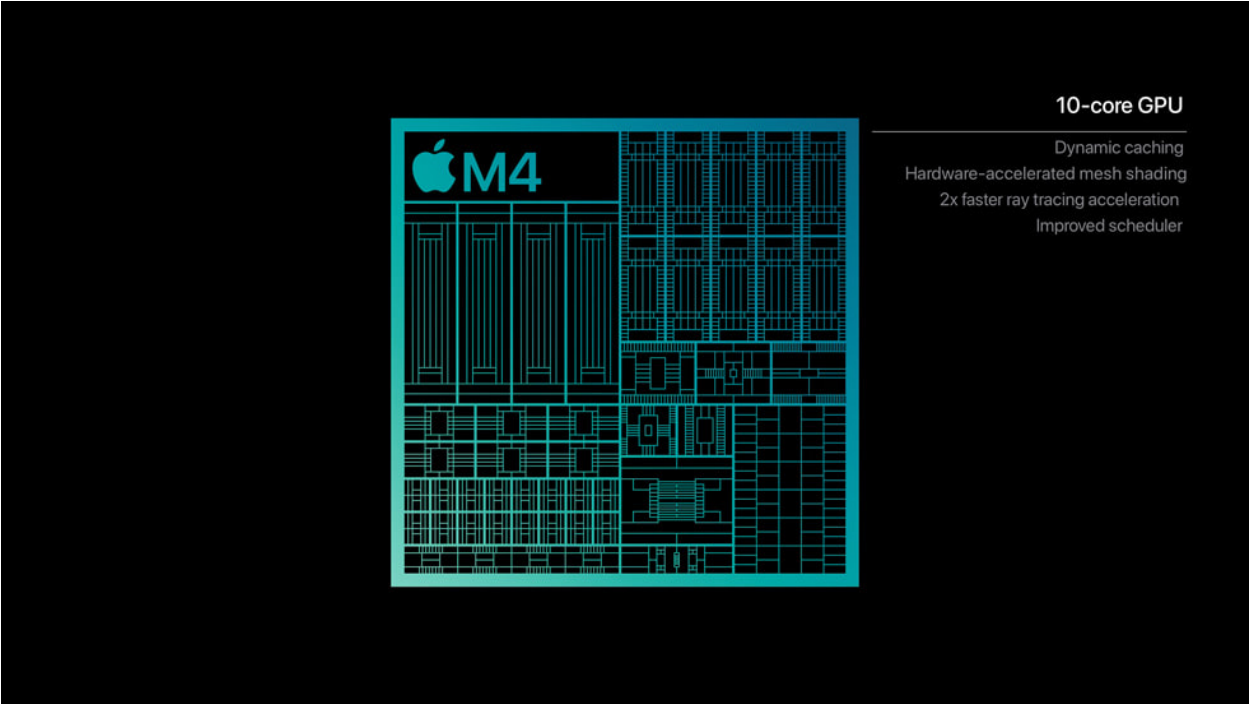
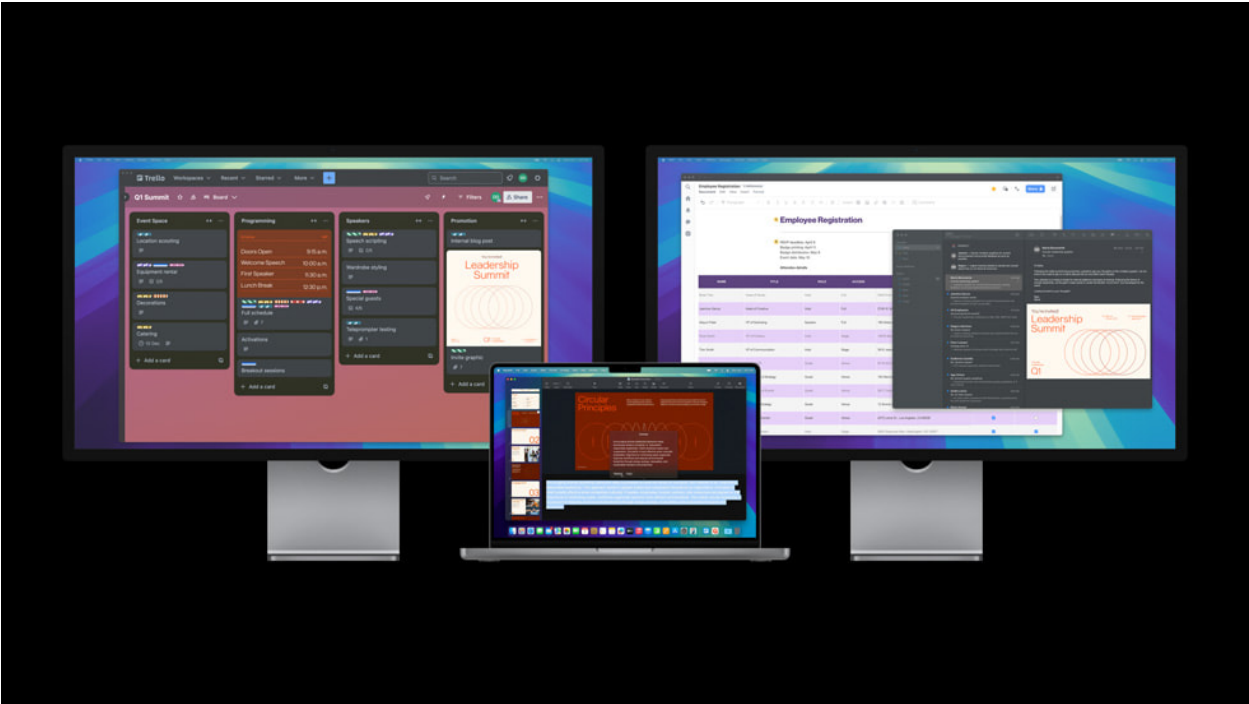Figure 3: A graphic shows the M4 chip's 10-core GPU.

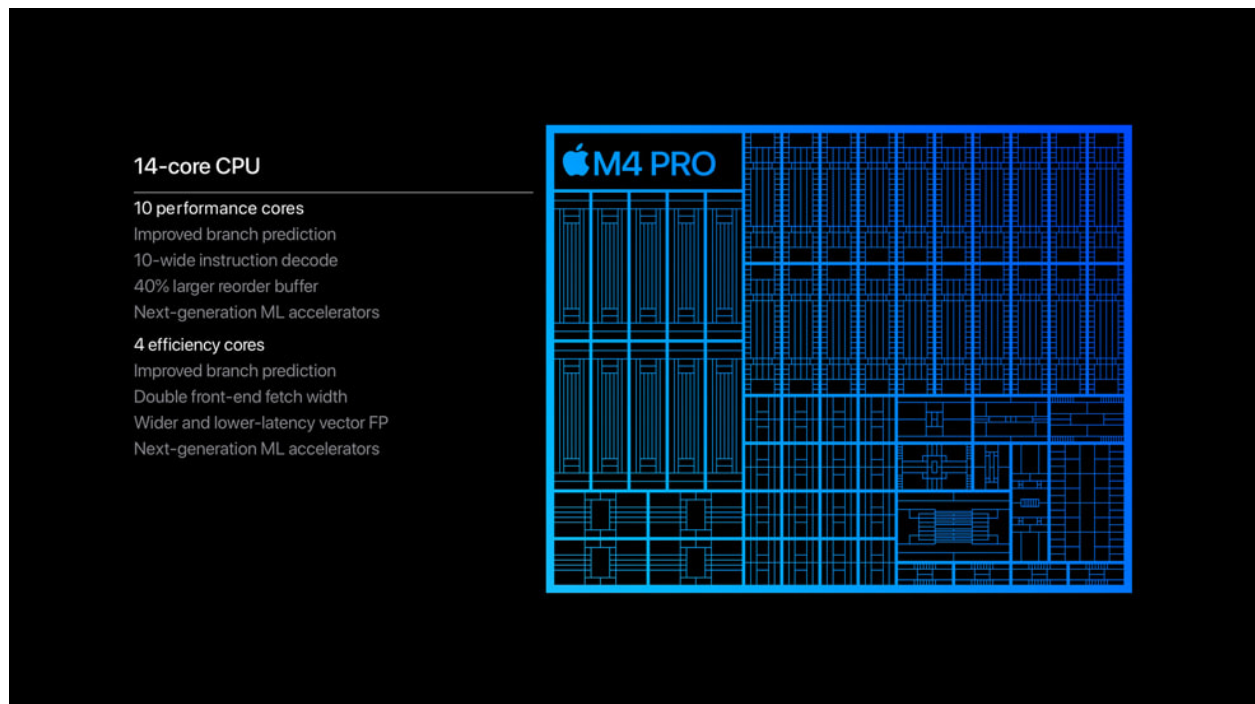Figure 4: A 14-inch MacBook Pro and two external displays.

Figure 5: A graphic shows the M4 Pro chip's 14-core CPU, with 10 performance cores and four efficiency cores.
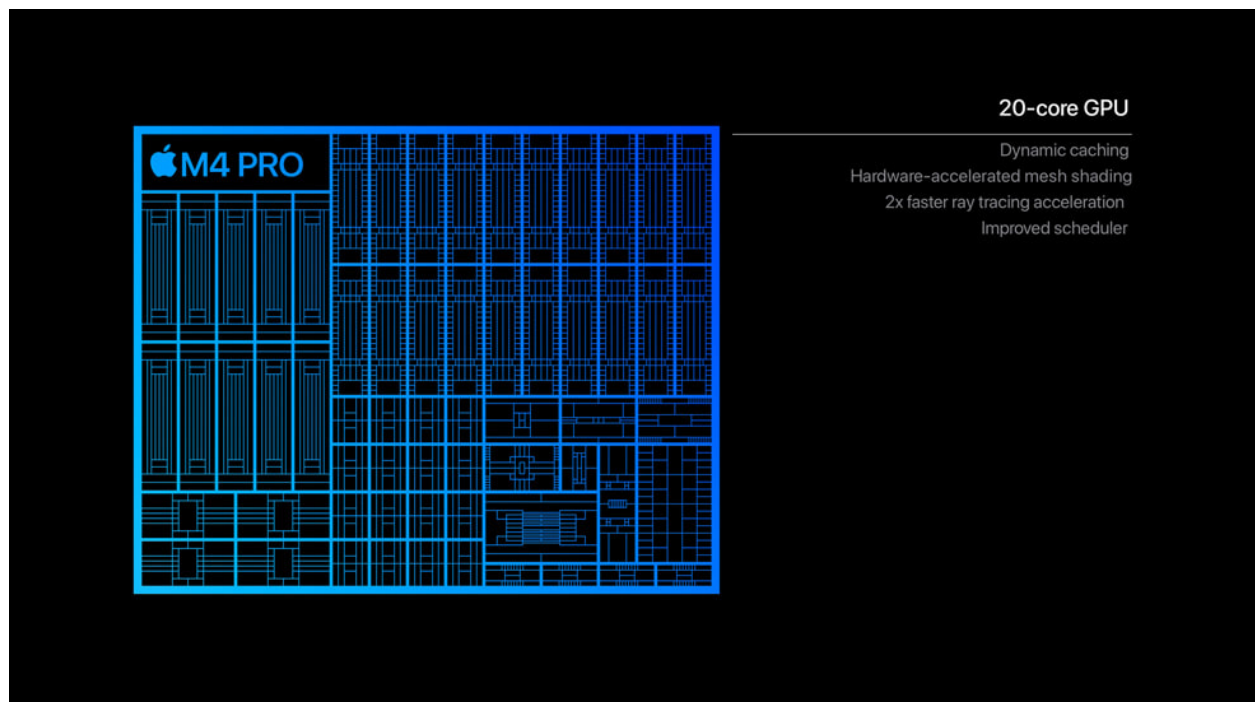

Figure 6: A graphic shows the 20-core GPU of M4 Pro.

The 20-core GPU of M4 Pro delivers graphics performance that is 2x that of M4, and up to 2.4x faster than the latest AI PC chip.

M4 Pro supports up to 64GB of fast unified memory and 273GB/s of memory bandwidth, which is a massive 75 percent increase over M3 Pro and 2x the bandwidth of any AI PC chip.3 This, combined with the faster Neural Engine of the M4 family, means on-device Apple Intelligence models run at blazing speed. M4 Pro also supports Thunderbolt 5 on Mac, delivering up to 120Gb/s data transfer speeds, which more than doubles the throughput of Thunderbolt 4. For professionals working on larger file sizes across AI, video, code bases, and more, M4 Pro offers stunning performance and Apple silicon's legendary power efficiency.

M4 Max: The Most Powerful Chip for a Pro Laptop

M4 Max is the ultimate choice for data scientists, 3D artists, and composers who push pro workflows to the limit. It has an up to 16-core CPU, with up to 12 performance cores and four efficiency cores. It's up to 2.2x faster than the CPU in M1 Max and up to 2.5x faster than the latest AI PC chip.2 The GPU has up to 40 cores for performance that is up to 1.9x faster than M1 Max and up to an astounding 4x faster than the latest AI PC chip.2 So heavy workloads like de-noising raw video footage in DaVinci Resolve Studio can now run in real time.
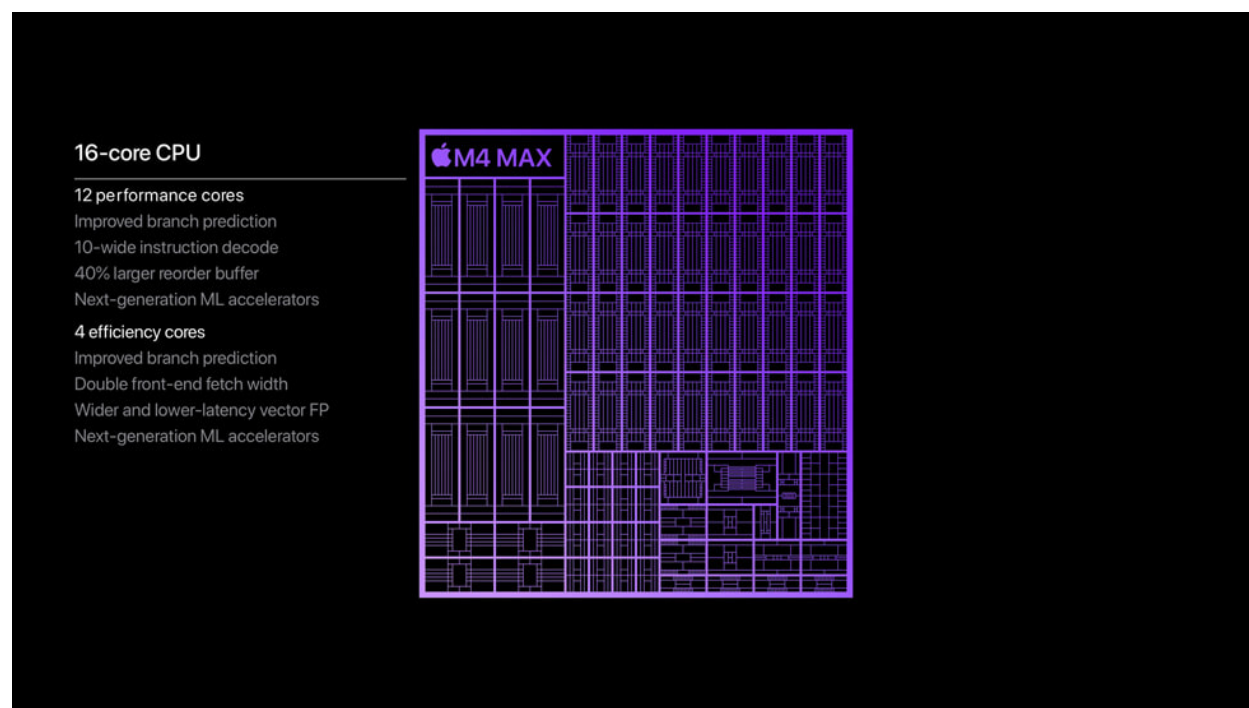

Figure 7: A graphic shows the M4 Max chip's 16-core CPU, with 12 performance cores and four efficiency cores.

M4 Max features a 16-core CPU that's up to 2.2x faster than the CPU in M1 Max, and up to 2.5x faster than the latest AI PC chip.

The massive 40-core GPU of M4 Max is up to 1.9x faster than M1 Max, and up to 4x faster than the latest AI PC chip.

M4 Max supports up to 128GB of fast unified memory and up to 546GB/s of memory bandwidth, which is 4x the bandwidth of the latest AI PC chip.3 This allows developers to easily interact with large language models that have nearly 200 billion parameters. The enhanced Media Engine of M4 Max includes two video encode engines and two ProRes accelerators, making it the ultimate choice for video professionals. And like M4 Pro, M4 Max also supports Thunderbolt 5 with up to 120Gb/s data transfer capability. M4 Max rips
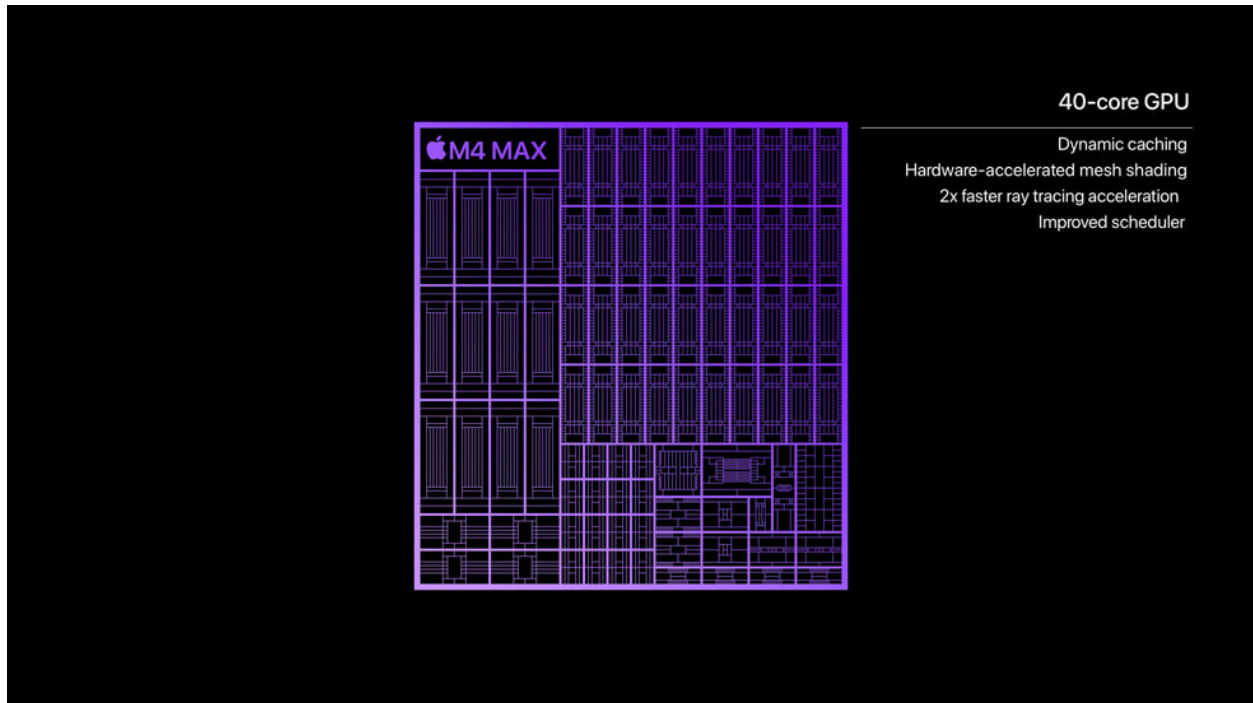
Figure 8: A graphic shows the 40-core GPU of M4 Max.

through the most challenging pro workloads and, thanks to the energy efficiency of Apple silicon, delivers exceptional battery life in a laptop.

The enhanced Media Engine of M4 Max features two video encode engines and two ProRes accelerators.

Apple Silicon Powers Apple Intelligence

M4, M4 Pro, and M4 Max are built for Apple Intelligence.4 Ushering in a new era for the Mac, Apple Intelligence brings personal intelligence to the personal computer. Combining powerful generative models with industry-first privacy protections, Apple Intelligence harnesses the power of Apple silicon and the Neural Engine to unlock new ways for users to work, communicate, and express themselves on Mac. It is available in U.S. English with macOS Sequoia 15.1. With systemwide Writing Tools, users can refine their words by rewriting, proofreading, and summarizing text nearly everywhere they write. With the newly redesigned Siri, users can move fluidly between spoken and typed requests to accelerate tasks throughout their day, and Siri can answer thousands of questions about Mac and other Apple products. New Apple Intelligence features will be available in December, with additional capabilities rolling out in the coming months. Image Playground gives users a new way to create fun original images, and Genmoji allows them to create custom emoji in seconds. Siri will become even more capable, with the ability to take actions across the system and draw on a user's personal context to deliver intelligence that is tailored to them. In December, ChatGPT will be integrated into Siri and Writing Tools, allowing users to access its expertise without needing to jump between tools.

With systemwide Writing Tools, users can refine their words by rewriting, proofreading, and summarizing text nearly everywhere they write.

Apple Intelligence does all this while protecting users'privacy at every step. At its core is on-device processing, and for more complex tasks, Private Cloud Compute gives users access to Apple's even larger, server-based models and offers groundbreaking protections for personal information. In addition, users can access ChatGPT for free without creating an account, and privacy protections are built in —their IP addresses are obscured and OpenAI won't store requests. For those who choose to connect their account, OpenAI's
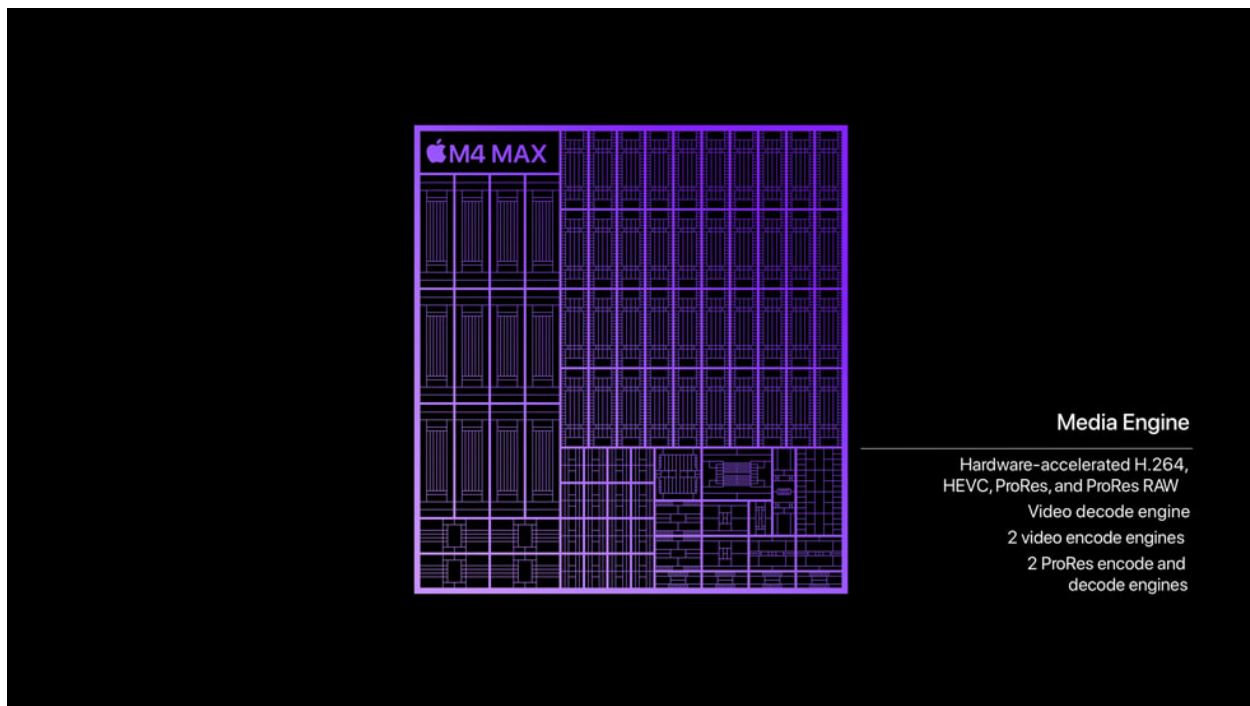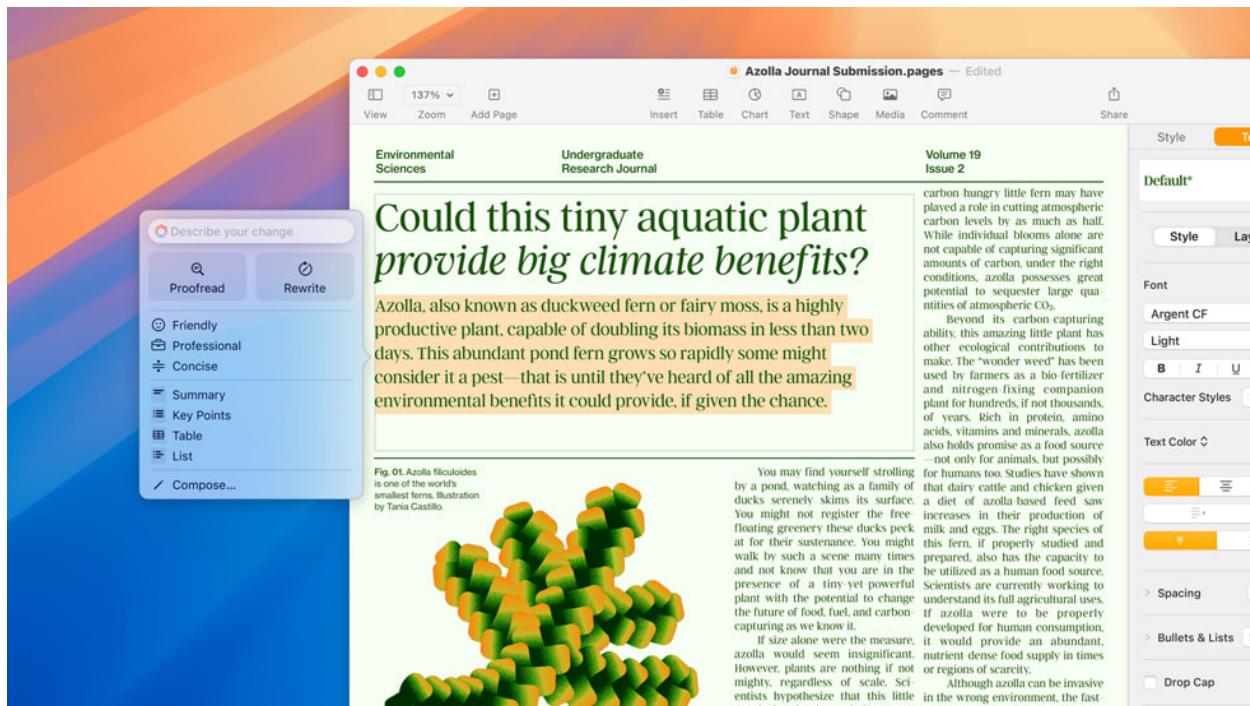
Figure 9: A graphic shows the Media Engine of M4 Max.

Figure 10: A Writing Tools screen features highlighted text from a scientific paper alongside proofreading and rewriting options.

data-use policies apply.

Better for the Environment

The power-efficient performance of M4, M4 Pro, and M4 Max helps the all-new MacBook Pro lineup meet Apple's high standards for energy efficiency and deliver up to 24 hours of battery life.5 This results in less time needing to be plugged in and less energy consumed over its lifetime. And for desktop systems like iMac and Mac mini, the energy efficiency of Apple silicon also reduces the total amount of energy used. Today, Apple is carbon neutral for global corporate operations and, as part of its ambitious Apple 2030 goal, plans to be carbon neutral across its entire carbon footprint by the end of this decade.

关于 Apple

Apple revolutionized personal technology with the introduction of the Macintosh in 1984. Today, Apple leads the world in innovation with iPhone, iPad, Mac, AirPods, Apple Watch, and Apple Vision Pro. Apple's six software platforms —iOS, iPadOS, macOS, watchOS, visionOS, and tvOS —provide seamless experiences across all Apple devices and empower people with breakthrough services including the App Store, Apple Music, Apple Pay, iCloud, and Apple TV+. Apple's more than 150,000 employees are dedicated to making the best products on earth and to leaving the world better than we found it.

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1. Testing was conducted by Apple in October 2024 using shipping competitive systems and select industry-standard benchmarks.
2. Testing was conducted by Apple in October 2024 using select industry-standard benchmarks. AI PC chip performance data from testing MSI Prestige 13 AI+ Evo (A2VMG-014US) with Core Ultra 7 258V.
3. Based on published technical specifications of shipping competitive chips as of October 2024.
4. Apple Intelligence is available now as a free software update for Mac with M1 and later, and can be accessed in most regions around the world when the device and Siri language are set to U.S. English. The first set of features is in beta and available with macOS Sequoia 15.1, with more features rolling out in the months to come. Apple Intelligence is quickly adding support for more languages. In December, Apple Intelligence will add support for localized English in *Australia*, *Canada*, *Ireland, New Zealand*, *South Africa*, and the *U.K.*, and in April, a software update will deliver expanded language support, with more coming throughout the year. Chinese, English (India), English (Singapore), French, German, Italian, Japanese, Korean, Portuguese, Spanish, Vietnamese, and other languages will be supported.
5. Testing was conducted by Apple from August through October 2024. Battery life varies by use and configuration. See apple.com/macbook-pro for more information.