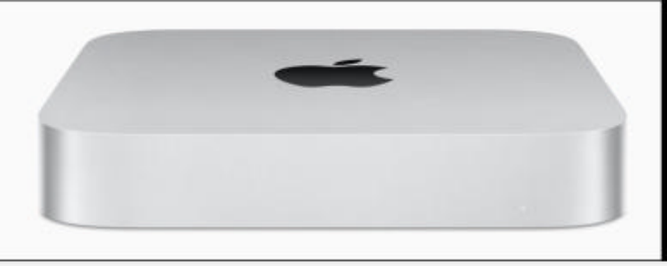

REVIEWED: MAC MINI (M2 PRO)

Macworld

MARCH 2023

APPLE'S EPIC NEW LAPTOP

16-INCH MACBOOK PRO (M2 PRO)

NEXT-GEN CHIPS: M2 PRO VS M2 MAX

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The latest Apple silicon Mac Pro rumour brings more disappointment

Now Apple's professional Mac reportedly won't support graphics cards either. **Michael Simon** reports

The Mac Pro is the final Intel Mac in the line-up, but it doesn't look like Apple saved the best for last. The latest rumour from Mark Gurman dumps a bucket of cold water on another anticipated feature: graphics card support.

According to a tweet from Gurman, who has leaked several Mac

Pro details recently, the Apple silicon Mac Pro "may lack user upgradeable GPUs." Along with speed, support for RAM and GPU upgrades are two of the main reasons users opt to spend £5,999 on the modular tower.

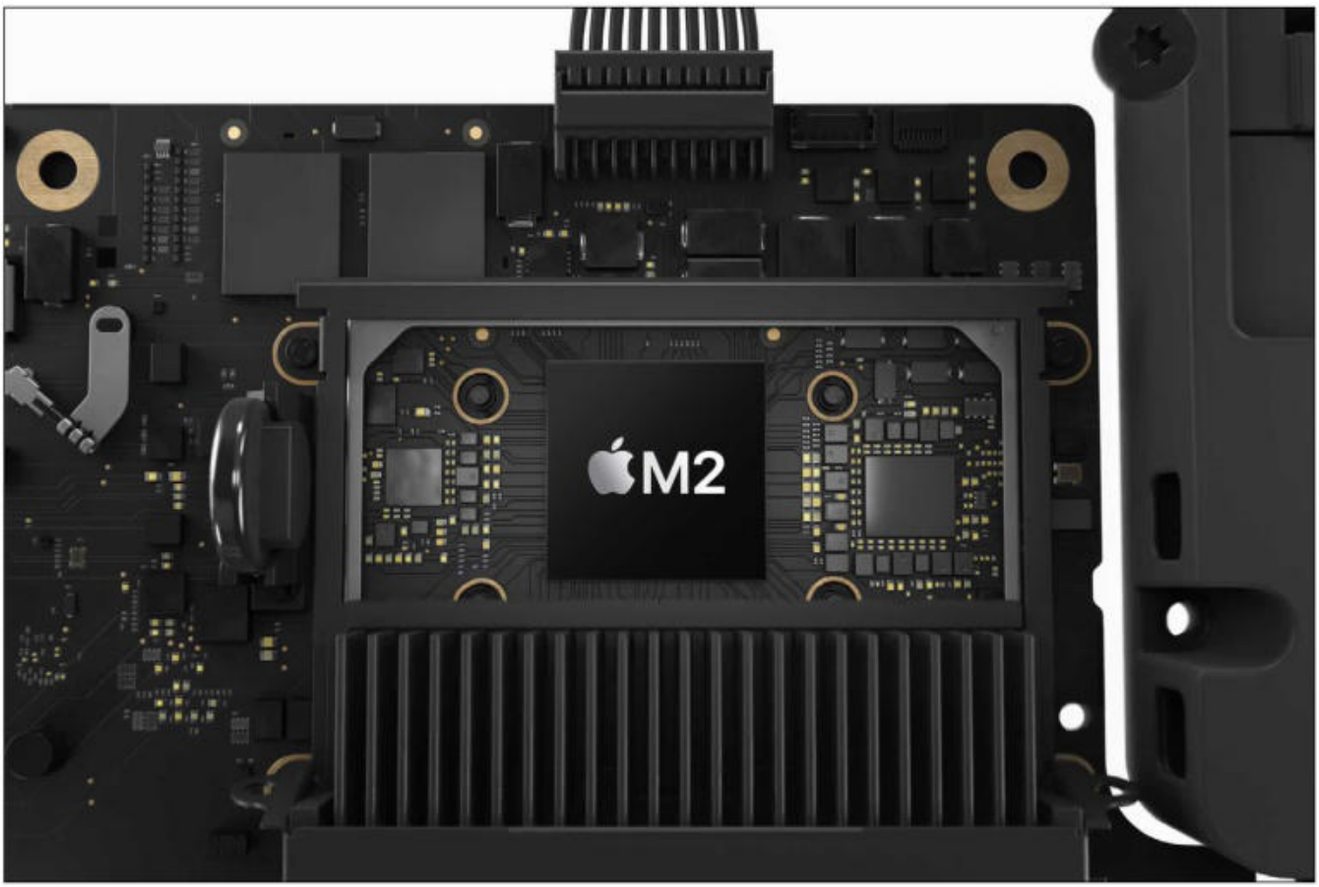
The next Mac Pro may lack user upgradeable GPUs in addition to non-upgradeable RAM. Right now Apple Silicon Macs don't support external GPUs and you have to use whatever configuration you buy on Apple's website. But the Mac Pro GPU will be powerful with up to 76 cores.
Mark Gurman (@markgurman)
January 26, 2023

That's yet another blow to the Mac Pro, which is looking less impressive with each passing rumour. Here's a recap of the news from the past few weeks:

- Rather than the M2 Extreme chip that was rumoured last year, the Mac Pro is expected to have an M2 Ultra chip with a 24-core CPU and 76-core GPU compared to the M1 Ultra's 20-core CPU and 64-core GPU.
- Like the rest of Apple's chips, the Mac Pro's processor will use unified memory built into the system-on-chip and therefore won't be upgradeable like the current model.
- The Apple silicon Mac Pro will have the same design as the Intel model.

And now, it reportedly won't have an upgradeable GPU either. According to Gurman, storage will be "the main user-upgradeable component in the new Mac Pro" and the biggest difference between the M2 Ultra in the Mac Pro and the M1 Ultra in the Mac Studio will be "performance from more cooling".

If the inside of the case is as empty as the reports indicate, there will be a lot of space for extra cooling.



Apple's entry-level SSD slowdown rears its ugly head again

By reducing NAND chips in the M2 Mac mini and M2 Pro MacBook Pro, Apple slows disk speeds in its latest Macs. **Roman Loyola** reports

Here at Macworld, we tend to recommend that customers not buy the entry-level configuration of any Mac. It generally doesn't have enough storage for most people, even people who rely heavily on iCloud or other cloud storage will likely run into space constraints down the line.

But there's another reason why you might want to avoid the entry-level configurations of Apple's latest Mac minis and MacBook Pros. While the new £649 M2 Mac mini is a very nice computer at a great price, it hides an ugly secret we've seen before: a slower SSD. MacRumours reports that benchmarks (fave.co/3wxtpHo) of the machine show that the 256GB SSD is up to 50 percent slower than the 256GB SSD in the M1 model it replaces.

The reason for the slowdown is the same as with the 256GB SSD in the 13-inch M2 MacBook Pro and M2 MacBook Air: Apple uses a single NAND chip in the SSD, while the M1 Macs they replaced used two NAND chips. YouTuber Brandon Geekabit (fave.co/3kGtaqR) confirmed that Apple uses one NAND chip in his teardown of the M2 Mac mini.

A single chip might be good for Apple's space-challenged engineers, but when it comes to SSD storage, there's a general principle that affects performance: an SSD uses multiple channels in parallel to read/write data to an SSD's NAND chips. The more chips that are in play, the more channels that are available, and the more channels available, the better the performance.

Somewhat surprisingly, the new base configurations of the MacBook Pro are also affected, despite having a 512GB SSD. 9to5Mac reports (fave.co/3wzYASE) that in its testing and teardown of the 14-inch MacBook Pro with a 10-core M2 Pro processor, the SSD is comprised of two 256GB NAND chips, half as many as found in the 512GB SSD in the M1 Pro model. And as a result of the fewer chips, the 512GB M2 Pro MacBook Pro has slower SSD performance than its predecessor. We assume the entry-level 16-inch MacBook Pro, which also has a 512GB SSD, has the same performance issues as well.

While we can understand the decision to use fewer chips in the lower-end Macs, the new MacBook Pro starts at £2,149 and is expected to be the ultimate in performance. Most users who buy one want the fastest speeds in all aspects of their machine. In the higher-end model we tested, disk speeds were as expected, with write scores that blew past the M1 Pro and M2.

After four models, it's clear that Apple has decided that the speed sacrifice is just something customers will have to live with when it comes to the cheapest configuration of its Macs. Granted, most users won't

feel the difference in everyday use and will only notice it the slowdown when using software that needs to read files from the SSD frequently, but we recommend getting at least a 1TB SSD anyway so there are enough data channels in use to make the speed difference unnoticeable.

Apple’s next big thing comes into view with huge ‘Reality Pro’ headset leak

Specs, design and ‘sci-fi-like interface’ have leaked for Apple’s AR-VR headset, which aims to ‘bring something new’. **David Price** reports

Extensive details of Apple’s upcoming ‘Reality Pro’ headset, which looks set to be the biggest release in years, have been revealed in a lengthy new report by Bloomberg’s Mark Gurman (fave.co/3JiTNwi).

Apple’s AR headset project has been the tech industry’s worst-kept secret for years, and it’s widely

assumed that 2023 will be the year we finally get to see it, probably at a dedicated spring event. But until now the details of the product have been relatively vague.

Gurman discusses what he refers to as Reality Pro in considerable depth. Presented as a summation of everything we know about the device, it necessarily covers some familiar ground: aside from the likely branding, we already expected the price to be somewhere in the vicinity of $3,000, around £2,425 (with a $1,500, around £808 version to follow next year), and much of the information relating to the cameras and displays have been reported before. But there's plenty to interest even the jaded student of Apple's AR plans.

He discloses, for example, that users will be able to switch between the product's AR and VR modes by using 'a so-called Digital Crown'. That's the name Apple gives to the pressable dial on the Apple Watch's righthand edge, but it isn't clear how closely this Digital Crown will follow that design; if the control's job is to toggle between two modes, a free-rotating dial would make less sense than a more conventional switch, but it might also serve for volume control purposes. Talking of sound, another intriguing titbit Gurman offers is that Reality Pro's speakers won't be anywhere near as impressive as its screens and that users will need to wear a pair of AirPods (bought separately, presumably) to get the full spatial audio effect.

The aluminium-and-glass design will reportedly be reminiscent of the AirPods Max. "The product will have a curved screen on the front that can outwardly show a wearer's eyes, with speakers on the sides and a headband that helps fit the device around a user's head," Gurman explains. "That will differ from the mostly plastic design of rival products, which typically stra the device to the wearer with multiple bands."

On the specs front, the device will be equipped with "a variation of the M2 chip found in the company's latest Macs", according to the report, but this will be supplemented by a dedicated 'Reality' processor for graphics and mixed-reality imagery. Gurman notes that this processing set-up will be so hardcore that overheating has been a concern for the engineers. For this reason, the battery will be carried separately (connected by a wire, which sounds

Apple's Reality Pro headset will reportedly take design cues from the AirPods Max.

suboptimal from a comfort and convenience point of view), and there may be a cooling fan onboard.

That battery – which is reportedly good for about two hours of use – won't be light, by the way. Roughly six inches tall and more than half an inch thick, Gurman says it will be "roughly the size of two iPhone 14 Pro Maxes stacked on top of each other". Confusingly, however, he adds that some prototypes have been created with a built-in battery.

Gurman also shared that the headset will be able to serve as an external monitor for your Mac and could have "a dedicated video-watching feature that can make viewers feel like they're seeing a movie on a giant screen in another environment, such as a desert or outer space". He also says the interface will be "nearly identical to that of the iPhone and iPad, featuring a home screen with a grid of icons that can be reorganized".

On the whole, in fact, the report is surprisingly pessimistic about the device, which appears beset by headaches and compromises. "Apple has acknowledged those challenges internally," Gurman notes, "and it's been trying to set realistic expectations for the product." The company may even regard the headset as an interest-generator that gets people into its stores, he says, before then buying something else. But in the long term, Apple hopes to break into a new and lucrative market it hasn't previously been able to access.

Gurman usually knows his stuff, and while he warns that plans may yet change ahead of the launch –

that handy caveat used by leakers across the industry – it's likely that his report is at least reasonably accurate. At any rate, we should find out concrete details later this year: While the headset is still "months from being released", Gurman says Apple intends to begin production in February and plans to launch the new device at a dedicated spring event or as part of the WWDC keynote in June.

Apple is poised to finally switch to superior microLED displays in 2024

The Apple Watch Ultra is reportedly getting a huge new feature that you probably won't notice. **David Price** reports

Apple hopes to decrease its dependence on Samsung and LG by making its own in-house mobile displays beginning in 2024, according to a new report. Aside from lowering costs and giving the company more freedom in the way it creates its devices, this move will also reportedly bring the advantages of microLED, a screen tech that is even more efficient than the OLEDs currently used.

Writing for Bloomberg (fave.co/406wb49), reputable leaker-analyst Mark Gurman says the

strategy will first affect the Apple Watch, whose premium Ultra model will get an in-house custom MicroLED with its 2024 update. In due course (and assuming no technical issues arise), the displays will be added to other Apple Watch models, and to the iPhone.

It's rumoured that the Apple Watch Ultra will get a bigger display in 2024.

It's worth noting that the 'in-house' part of the report is a somewhat relative term. Most likely these displays will still be manufactured by an external supplier; the difference is that Apple will have more control over their design. As it stands, Apple works with existing Samsung and LG tech to craft its iPhone and Apple Watch displays and calibrates them to Apple's specifications. Now Apple would be responsible for the conception and design of the display itself, giving it more control over the end product. Samsung currently makes a microLED display, but it's only used in its high-end television sets.

MicroLED may become the dominant display technology within a few years, and offers superior performance to OLED in a number of ways:

1. It's thinner, lending itself to a lower-profile and lighter smartwatch.
2. It's roughly twice as power-efficient (to be more precise, it's estimated to use about half as much energy to produce an equivalent brightness), with obvious benefits for battery life.
3. MicroLED is capable of offering many times greater screen resolution, with several thousand pixels per inch a feasible aim a little way down the line.
4. For that matter, it's also capable of a better image in almost every way, with superior colour, contrast and brightness. Bloomberg says the

displays are already being tested, and “make content appear like it’s painted on top of the glass”.
5. And it’s more resistant to screen burn-in, which can be an issue for OLED displays.

Needless to say, these are all qualities that users probably won’t notice on a 2-inch display but would be highly prized by the engineers working on various Apple mobile products. In our 4.5-star review of the Apple Watch Ultra, we found the first-gen model to be overly thick, and being able to slim down both the display and battery without impacting performance would be ideal. Recent rumours suggested that the Apple Watch Ultra would be getting a bigger and brighter display in 2024 as well, which tracks with this rumour.

The timeframe, of course, may mean the change comes too late for the second-gen Ultra. It all depends on the release schedule, which hasn’t yet been established. Rumours suggest that the Ultra will have a biennial cadence, like the SE, but we’ll have to wait until September to see what Apple has planned. And even if the second Ultra doesn’t arrive until fall 2024, it could still miss out, as Gurman warns that the project could yet slip to 2025.

You can own Apple's 'most important flop' for free

Before the Mac, there was Lisa, and after 40 years, the source code is free to download. **Roman Loyola** reports

Before there was the Mac, there was the Lisa, Apple's first computer to feature a graphical user interface. Lisa was released 40 years ago this year, and to celebrate the anniversary, the Computer History Museum – which calls Lisa "Apple's most important flop" – is offering the source code of the Lisa software free to download (fave.co/408fvsX).

The download is a mere 7MB compressed, 30MB expanded. You do, however, have to agree to a license agreement before you can get the download, and provide your name

and email address. And then once you download it, you'll need to figure out how to run it (fave.co/3Ha85g5).

A look at the Lisa GUI tells you instantly where the Mac has its roots. In fact, the Mac's desktop still takes its cues from Lisa, with pulldown menus across the top and icons for files and apps. The Lisa software ran on a Motorola 68000 and even allowed for multitasking, but the 68000 had a hard time handling the Lisa software, and the computer was slow and expensive, and it became a footnote after the Mac launched in 1984.

Named after Steve Jobs's daughter, the Lisa made its debut on January 19, 1983. It was priced at $9,995, which was several thousand dollars more expensive than IBM PCs with command-line interfaces. Apple hoped that the GUI was enough to overcome the high price and slow performance, but the computer didn't sell.

The Macintosh made its debut in 1984, at a more reasonable $2,495, Apple also released new Lisa computers at the same time, but it was the Mac that caught on, and Lisa was eventually scrapped. Suffice to say, without Lisa there would be no Mac, and the history of the machine is fascinating. You can learn more about the history of Lisa on the Computer History Museum website (fave.co/408fvsX).

Review: 16-inch MacBook Pro (M2 Pro)

Price: £2,699 from fave.co/3wx5VlS

In the autumn of 2021, Apple's 14- and 16-inch MacBook Pros made a grand entrance into the Mac line-up, and made an instant impact, combining processing prowess with a sophisticated redesign. If you were aching for a new high-end MacBook Pro, the 2021 release offered soothing relief.

But maybe you decided to wait a little longer. Maybe you thought it would be wise to let a generation of Apple silicon pass so the company can work out the kinks and app developers can catch up with native software. Or maybe you just weren't convinced this whole thing was really going to work, despite Apple's past

success with silicon transitions. Whatever the reason, let me tell you, for most people, there isn't a reason to wait any longer. The transition has been smooth for the most part, tons of native software from third-party developers are available, and the M-series SoC is here to stay.

Actually, you benefit from waiting, because the new M2 Pro/Max offers a nice performance boost over the previous M1 Pro and M1 Max machines. On top of that, you get a much-needed upgrade for HDMI and futureproofing with Wi-Fi 6E and Bluetooth 5.3 – three features that might even be enough for current M1 Pro or M1 Max MacBook Pro owners to upgrade.

This review takes a look at the new 16-inch MacBook Pro. For a full list of specifications, see page 31.

This model takes the £2,699 standard configuration and upgrades the memory from 16GB to 32GB (a £400 upgrade) and the SSD from 512GB to 2TB (another £600). That brings the total price of our review unit to £3,699.

BRIEF OVERVIEW

Apple offers the MacBook Pro with the M2 Pro and M2 Max in different CPU, GPU, and memory set-ups, and it can get confusing to sort out what's included with each chip at each standard configuration. Here's an overview of what you need to know:

- For its lowest-priced (£2,149) 14-inch configuration, Apple offers a scaled-down version of the M2 Pro with 6 performance cores and 4 efficiency cores, and a 16-core GPU.
- The M2 Pro with 12 CPU cores, 19 GPU cores, and 16GB of unified memory is offered in the mid-tier (£2,699) 14-inch MacBook Pro, and the low-end (£2,699) and mid-tier (£2,899) 16-inch MacBook Pro.
- Both the high-end 14- (£3,349) and 16-inch (£3,749) MacBook Pro have the M2 Max, but the 14-inch laptop's chip has a 30-core GPU, while the 16-inch laptop has a 38-core GPU.
- Each configuration can be customized to upgrade the GPU, memory, and SSD.

The M2 Pro in our review unit has a 12-core CPU, which is divided into 8 performance cores and 4 efficiency cores. In his overview of the M2 Pro and Max (see page 47), Macworld's Jason Cross points out that M2 Pro and M2 Max appear to be scaled-up versions of the M2 used in the new Mac mini, MacBook Air and 13-inch

MacBook Pro – these new chips don't use new manufacturing processes, GPUs, or anything else. The chip that the M2 Pro replaces, the M1 Pro, had 10 CPU cores; it had two fewer efficiency cores.

PERFORMANCE

These new laptops are all about the new M2 Pro and M2 Max processors, so the focus of this review is mostly on the benchmark performance of the M2 Pro in our review unit. The M2 Pro's architecture is based on the M2, but Apple makes enhancements to boost performance.

Our benchmarks compare the M2 Pro's performance to the M1 Pro and M1 Max, as well as the M2. For some tests, we were also able to include an older Intel-based 16-inch MacBook Pro.

Geekbench 5 (multi core CPU)

16-inch MacBook Pro M2 Pro 12-core (2023): 15,079
14-inch MacBook Pro M1 Max 10-core (2021): 12,590
14-inch MacBook Pro M1 Pro 10-core (2021): 12,544
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 7,383
13-inch MacBook Pro M2 8-core (2020): 8,908

Geekbench 5 (single core CPU)

16-inch MacBook Pro M2 Pro 12-core (2023): 1,960
14-inch MacBook Pro M1 Max 10-core (2021): 1,774
14-inch MacBook Pro M1 Pro 10-core (2021): 1,778
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 1,277
13-inch MacBook Pro M2 8-core (2020): 1,943

Apple proclaims a 20 percent improvement for the M2 Pro over the M1 Pro, and our Geekbench 5 Multi CPU benchmark result hits that square on the nose. Apple also said the M2 Pro is twice as fast as the M2, but we didn't see that in Geekbench. In Geekbench's single CPU benchmark, the M2 Pro had a similar score as the M2, which isn't surprising. This test involves a single CPU core, and since the M2 Pro and M2 basically have the same type of individual cores, the results will be the same.

Cinebench (multi core CPU)

16-inch MacBook Pro M2 Pro 12-core (2023): 14,783
14-inch MacBook Pro M1 Pro 10-core (2021): 12,381
13-inch MacBook Pro M2 8-core (2022): 8,733

Cinebench (single core CPU)

16-inch MacBook Pro M2 Pro 12-core (2023): 1,645
14-inch MacBook Pro M1 Pro 10-core (2021): 1,531
13-inch MacBook Pro M2 8-core (2022): 1,645

The 20 percent improvement appears again in the Cinebench R23 Multi Core CPU tests. Cinebench, which performs 3D modeling, is the kind of benchmark where chips with more CPU cores, the better. This benchmark is a better indicator of performance for the intended use of the M2 Pro MacBook Pro: graphics pros who put heavy demands upon the CPU.

These new laptops are all about the new processors.

Handbrake 1.4 video encode (H.265 x265)

16-inch MacBook Pro M2 Pro 12-core (2023): 491
14-inch MacBook Pro M1 Pro 10-core (2021: 670
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 1,277
13-inch MacBook Pro M2 8-core (2022): 935

Handbrake 1.4 video encode (H.265 Video ToolBox)

16-inch MacBook Pro M2 Pro 12-core (2023): 158
14-inch MacBook Pro M1 Pro 10-core (2021: 287
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 327
13-inch MacBook Pro M2 8-core (2022): 250

We used Handbrake to encode the Tears of Steel video from 4K to a 1080p H.265 file. When doing the encoding completely in software using the H.265 (x265) video encoder, the M2 Pro showed a 37

percent speed improvement over the M1 Pro. With Handbrake's H.265 (VideoToolBox) encoder, the app takes advantage of available hardware acceleration, so when VideoToolBox was used, the M2 Pro had a 20 percent improvement.

iMovie 4K video toolbox: Export 4K file Best (ProRes)

16-inch MacBook Pro M2 Pro 12-core (2023): 62
14-inch MacBook Pro M1 Pro 10-core (2021): 66
13-inch MacBook Pro M2 8-core (2022): 123

iMovie 4K video toolbox: Export 4K file (High)

16-inch MacBook Pro M2 Pro 12-core (2023): 276
14-inch MacBook Pro M1 Pro 10-core (2021): 271
13-inch MacBook Pro M2 8-core (2022): 284

iMovie 4K video toolbox: Stabilize shaky video

16-inch MacBook Pro M2 Pro 12-core (2023): 167
14-inch MacBook Pro M1 Pro 10-core (2021): 231
13-inch MacBook Pro M2 8-core (2022): 271

With the M2, Apple introduced enhancements to the media engine in the CPU to improve audio and video encoding and decoding. The M2 Pro performed our iMovie 4K video export at Best (ProRes) quality in half the time it took the M2, but compared to the M1 Pro, the results were the same.

This task involves writing to the SSD, which has an effect on the improvement between the two Pro chips. When exporting the same video at High quality (not ProRes), the performance was practically the same between the M2, M1 Pro and M2 Pro.

Before doing the iMovie exports, we measured the amount of time it took to perform a stabilize shaky video function. The M2 MacBook Pro demonstrated a noticeable improvement of 28 percent over the M1 Pro.

Blackmagic Disk Test (read)

16-inch MacBook Pro M2 Pro 12-core (2023): 5,372
14-inch MacBook Pro M1 Pro 10-core (2021): 5,797
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 2,560
13-inch MacBook Pro M2 8-core (2022): 2,776

Blackmagic Disk Test (write)

16-inch MacBook Pro M2 Pro 12-core (2023): 6,491
14-inch MacBook Pro M1 Pro 10-core (2021): 5,321
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 2,670
13-inch MacBook Pro M2 8-core (2022): 3,022

The 20 percent improvement continues in the Blackmagic Disk Test write benchmark for the SSD. Interestingly, the 2TB SSD in our review unit posted a read score that was 7 percent slower than the 1TB SSD in the 14-inch M1 Pro MacBook Pro that we tested – that's small enough to be barely noticeable. The M2 Pro's SSD more than doubled the performance of the M2 13-inch MacBook Pro, which we tested with a 1TB SSD.

We also ran the AmorphousDiskMark (fave.co/3R8KoJL) benchmark and the M2 Pro and M1 Pro posted similar read results of 6.71GB/s and 6.77GB/s, respectively, while the M1 posted a read rating of 2.4GB/s. In another SSD benchmark tool, Stibium (fave.co/3Hei6c5), the M2 Pro's read rating was 7.89GB/s, while the M1 Pro posted 7.05GB/s and the M1's read was 2.06GB/s.

GRAPHICS PERFORMANCE

The M2 Pro MacBook Pro has some serious GPU power. (If you need more, you can get more with the M2 Max.) We're used to seeing cores in even number sets, so to see the M2 Pro has a 19-core GPU which is odd (literally) – 20 GPU cores would make it exactly double that found in the M2.

We were blown away by the MacBook Pro's performance.

Rise of the Tomb Raider: 1,920x1,200 (High)

16-inch MacBook Pro M2 Pro (2023): 110fps
14-inch MacBook Pro M1 Pro 10-core (2021): 87fps
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 51fps
13-inch MacBook Pro M2 8-core (2022): 52fps

Rise of the Tomb Raider: 1,280x800 (Medium)

16-inch MacBook Pro M2 Pro (2023): 157fps
14-inch MacBook Pro M1 Pro 10-core (2021): 120fps
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 101fps
13-inch MacBook Pro M2 8-core (2022): 82fps

Civilization VI: 1,920x1,200 (High)

16-inch MacBook Pro M2 Pro (2023): 65fps
14-inch MacBook Pro M1 Pro 10-core (2021): 50fps
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 51fps
13-inch MacBook Pro M2 8-core (2022): 53fps

Civilization VI: 1,280x800 (Medium)

16-inch MacBook Pro M2 Pro (2023): 83fps
14-inch MacBook Pro M1 Pro 10-core (2021): 66fps
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 68fps
13-inch MacBook Pro M2 8-core (2022): 69fps

Rise of the Tomb Raider and Civilization VI are older games written for Intel and not optimized for Apple's Metal graphics API, but these games still see a significant boost with the M2 Pro. At each game's higher resolution settings, Tomb Raider and Civilization VI both saw jumps in framerate of 27 and 30 percent,

Civilization VI was written for Intel and not optimized for Apple's Metal graphics API, but still sees a significant boost with the M2 Pro.

respectively. Tomb Raider on the M2 Pro doubled its framerate from the M2.

We can also see in this set of tests that the M2 Pro's 19-core GPU creates more separation between it and the 8GB AMD Radeon Pro 5500M GPU in the 16-inch MacBook Pro with an Intel 2.4GHz Core i9 8-core CPU from 2019. Granted, that AMD GPU is three years old and obsolete, but the margin the M2 Pro created is significant.

Geekbench 5 Compute (Metal)

16-inch MacBook Pro M2 Pro 12-core (2023): 51,587
14-inch MacBook Pro M1 Max 10-core (2021): 68,534
14-inch MacBook Pro M1 Pro 10-core (2021): 42,862
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 25,395
13-inch MacBook Pro M2 8-core (2020): 30,001

Geekbench 5 Compute (OpenCL)

16-inch MacBook Pro M2 Pro 12-core (2023): 44,727
14-inch MacBook Pro M1 Max 10-core (2021): 59,774
14-inch MacBook Pro M1 Pro 10-core (2021): 37,330
16-inch MacBook Pro 2.4GHz 8-core Core i9 (2019): 27,594
13-inch MacBook Pro M2 8-core (2020): 27,284

Geekbench 5's Compute benchmark tests GPU performance using OpenCL or Metal APIs. In both of these tests, the M2 Pro and its 19-core GPU were 20 percent faster than the M1 Pro and its 16-core GPU. Considering that going from 16 cores to 19 cores works out to about 19 percent more core power, the 20 percent boost falls right in line.

I ran several other graphics benchmarks in order to compare the performance between the M2 Pro and M1 Pro. These tests came out as expected, with the M2 Pro blazing past the M1 Pro, usually by about 20 percent, but sometimes higher. Here's a list of the tests.

- 3DMark Wild Life (fave.co/3XNBTpZ) is an iOS app – you can run iOS apps on Apple silicon Macs, in case you didn't know or forgot. This graphics test is native to Apple silicon and uses Apple's Metal API. The M2 Pro posted a 26 percent improvement over the M1 Pro in the test's Extreme Unlimited mode.

16-inch MacBook Pro M2 Pro 12-core CPU, 19-core GPU (2023): 12,943

14-inch MacBook Pro M1 Pro 10-core CPU, 16-core GPU (2021): 10,259

• Basemark GPUScore: Sacred Path (fave.co/3Jf2XtU) runs natively on Apple silicon. This high-end 3D graphics test uses the Metal API. It's also available for Windows and Linux. The M2 Pro provided a 25 percent boost over the M1 Pro.

16-inch MacBook Pro M2 Pro 12-core CPU, 19-core GPU: 6,341
14-inch MacBook Pro M1 Pro 10-core CPU, 16-core GPU (2021): 5,061

• Basemark GPU (fave.co/3WJGfNE) uses Basemark's Rocksolid proprietary graphics engine to generate graphical scenes similar to those you'd find in a video game. This benchmark is native to Apple silicon and we ran it using Metal. The M2 Pro's score was 18 percent better than that of the M1 Pro.

16-inch MacBook Pro M2 Pro 12-core CPU, 19-core GPU (2023): 5,787
14-inch MacBook Pro M1 Pro 10-core CPU, 16-core GPU (2021): 4,888

• Corona Benchmark (fave.co/3RdlqZz) is an older benchmark and runs using Rosetta. that performs a 3D render test using the Corona Renderer. The M2 Pro was 19 percent faster than the M1 Pro.

16-inch MacBook Pro M2 Pro 12-core CPU, 19-core GPU (2023): 116
14-inch MacBook Pro M1 Pro 10-core CPU, 16-core GPU (2021): 143

• V-Ray 5 Benchmark (fave.co/3HCVmUw) is not native to Apple silicon and uses Rosetta. Its two tests use the V-Ray 3D rendering engine. In the V-Ray 5 CPU test, the M2 Pro results showed a 27 percent improvement over the M1 Pro. In the V-Ray 5 GPU CUDA test, the M2 Pro had a 21 percent increase over the M1 Pro.

16-inch MacBook Pro M2 Pro 12-core CPU, 19-core GPU (2023): 9,707
14-inch MacBook Pro M1 Pro 10-core CPU, 16-core GPU (2021): 7,660

BATTERY AND CHARGING

Apple claims a 22-hour battery life with 'Apple TV app movie playback' for the M2 MacBook Pro, which is an hour longer than the M1 model it replaces. To test this claim on the 100-watt-hour lithium-polymer battery, I played a full-screen video on a continuous loop until the battery ran out – which

Apple includes a USB-C to MagSafe cable and a 140-watt power adapter.

happened 27 hours later. (Our test is done with the display at 150 nits, which is dimmer than the '8 clicks from bottom' brightness Apple sets its video playback test.) If you're going to be doing more strenuous work on the MacBook Pro than watching video – compiling code, rendering graphics, creating files, and so on, so you'll probably need to plug in before you reach the 22nd hour. But still, the battery life is long enough to last a day no matter what you're doing.

Apple includes a 140-watt USB-C power adapter with the 16-inch model, while the 14-inch model has a 96-watt adapter (you get a 67-watt adapter if you buy the £2,149 14-inch model). When you use the 140-watt adapter with the 16-inch MacBook Pro, Apple says that fast charging kicks in and fills the battery up to 50 percent in 30 minutes. When I drained the MacBook Pro's battery to test its life, I found that fast charging works just as Apple says it would – it got to 50 percent in just under 30 minutes.

Apple did make one minor change with the MagSafe cable: the Space Gray model comes with the Space Gray cable that was introduced with the MacBook Air. The previous model's cable came in silver, regardless of what colour laptop you specified.

EVERYTHING ELSE

When Apple introduced the Apple silicon MacBook Pro in 2021, it not only ushered in the M-series chips to Apple's high-end laptop, but the company also unveiled a major redesign with a new display, keyboard configuration, and upgraded FaceTime camera.

Suffice it to say, that was a lot of new stuff that Apple brought us two years ago, so it's not surprising to find out that Apple didn't change much this time around. The design and keyboard tend to stick around

for several generations, and Apple will upgrade displays when new technologies become more viable at an affordable scale, which means it takes a few years.

Fortunately, Apple did an excellent job with these features, which I covered in great detail in my review of the 14-inch MacBook Pro (fave.co/3Y1MZr3) and summarized below.

Design: The case is made of recycled aluminium, and it feels great in your hands. It has the look and feel of a luxury product.

Display: The Liquid Retina XDR (mini-LED) display is bright, provides excellent detail, and supports ProMotion, which adjusts the refresh rate based on what's on the screen. It's the best display Apple has used on a laptop to date.

The display, however, still has a notch, a module at the centre top of the display that houses the FaceTime camera. I've never been bothered by it and it doesn't infringe on the workspace below it. While the iPhone 14 Pro uses its Dynamic Island interface with its display notch, the MacBook Pro does not. Maybe someday Apple will update macOS with a Mac version of Dynamic Island, but in the meantime, you can find utilities that can hide or highlight the notch.

The Liquid Retina XDR display on the 16-inch MacBook Pro leaves quite an impression with its amazing colour and detail.

FaceTime camera: Since we were talking about the notch… this is the one exception to Apple's excellent job that I mentioned earlier. The 1080p FaceTime camera is the most disappointing part of what is considered

Apple's premier laptop for professionals. Its image quality is sorely lacking compared to third-party cameras that are available. If you have an iPhone 8 or XR or later, use Continuity Camera instead.

Apple upgraded the HMDI port to version 2.1, which expands the ability to connect an external display.

Keyboard: It's the same as with the 2021 model, with full-sized Function keys instead of the Touch Bar. If the Touch Bar is a make-or-break feature for you, your only choice is to go with the 13-inch MacBook Pro with an M2 chip.

HDMI GETS AN UPGRADE

The new 14- and 16-inch MacBook Pro has the same ports as before: 3 Thunderbolt 4/USB-C ports, a MagSafe 3 port, a headphone jack, an SDXC card slot, and an HDMI port. However, Apple did upgrade the HDMI port from supporting version 2.0 of the spec to version 2.1.

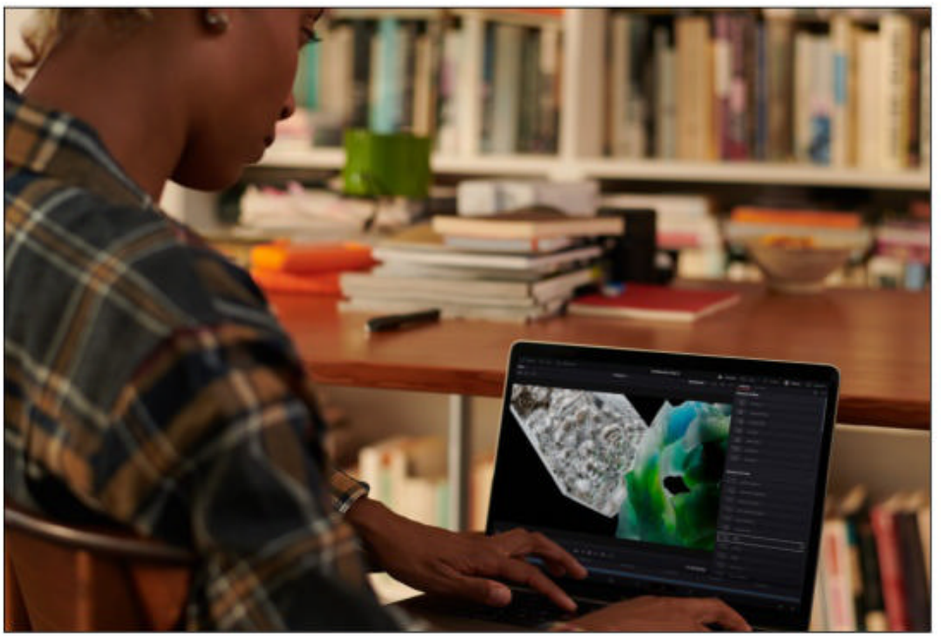
That little HDMI upgrade is a big deal because it allows more flexibility as to the kind of external display you can use. With HDMI 2.0, you could connect one display with up to 4K resolution at 60Hz and that's it. With the new HDMI 2.1 port on an M2 Pro MacBook Pro, you can connect:

- One display either at 8K resolution at 60Hz, or at 4K resolution at 240Hz.
- One display at up to 4K resolution at 144Hz, and another display connected via Thunderbolt at up to 6K resolution at 60Hz.

Since the MacBook Pro is used by content professionals, this new external display support is a key feature. Apple likely lost some potential MacBook customers due to subpar HDMI support. This upgrade could get those customers back.

VERDICT

The original introduction of the M1 Pro/Max MacBook Pro over two years ago brought with it a ton of excitement. It wasn't just a new model. With a new chip, new design and new features, it was also a new vision for the product line.



If you need an upgrade this is well worth the money.

Compared to that release, the unveiling of the M2 Pro upgrade is low-key – some might even say mundane. Maybe that's unfair since the 2021 edition was so good and Apple didn't really need to change much. But there are still valuable updates in addition to the new chip, such as HDMI 2.1, Wi-Fi 6E and Bluetooth 5.3 that make the new 16-inch Pro an upgrade-worthy release.

In short, the M2 MacBook Pro is a successful follow-up to the M1 model. If you're still using an Intel-based laptop and have the money to invest in a new MacBook Pro, there's only one good reason why you shouldn't upgrade: you have important software that won't run natively on Apple silicon. And if that's the case, you need to figure out what to do about it, because Apple silicon is here to stay. The sooner you can join the revolution, the better.

If you already invested in an M1 Pro or M1 Max MacBook Pro, you can probably wait for the M3 or M4 model to arrive, unless that 20 percent performance boost is absolutely what you need. While the HDMI upgrade is important, you've probably already adjusted to make your display set-up work. And you won't feel the need for Wi-Fi and Bluetooth upgrades for a while. But if you have a few thousand pounds saved and have been waiting for this generation to arrive, your money will absolutely be well spent.

Roman Loyola

SPECIFICATIONS

- 16.2in (3,456×2,234; 254ppi) Liquid Retina XDR display
- macOS Ventura
- M2 Pro processor
- 12-core CPU with 8 performance cores and 4 efficiency cores
- 19-core GPU
- 16-core Neural Engine
- 200GB/s memory bandwidth
- 16GB RAM (configurable to 32GB/64GB/94GB)
- 512GB of SSD storage (configurable to 1TB/2TB/4TB/8TB)
- 1080p FaceTime camera
- Backlit Magic keyboard with Touch ID
- Force Touch trackpad
- SDXC card slot
- MagSafe 3
- HDMI
- 3x Thunderbolt 4 ports
- 3.5mm headphone jack
- High-fidelity six-speaker sound system (with support for Spatial Audio)
- 802.11ax Wi-Fi 6E
- Bluetooth 5.3
- 100Wh lithium-polymer battery
- 355.7x248.1x16.8mm
- M2 Pro, 2.15kg; M2 Max, 2.16kg

5 reasons to upgrade your 2021 MacBook Pro to an M2 Pro or M2 Max model

Most people will probably stick with what they have, but there are a few reasons to trade in your 2021 model. **Michael Simon** reports

Apple's new 14- and 16-inch MacBook Pros with M2 Pro and M2 Max processors aren't nearly as exciting as their predecessors. They have the same display, design, and ports, and the processor is a small speed bump compared to the massive leap with the 2021 redesign. But even if you spent thousands of pounds on an M1 Pro or M2 Max model, there are still a few reasons why power users might want to trade in their M1 model and upgrade.

1. YOU DO A LOT OF GRAPHICS WORK

The new models Apple just released have M2 Pro and M2 Max processors that are obviously faster than their predecessors. But the real gains are on the graphics side, where the 19-core GPU in the M2 Pro boats about a 30-percent boost over the M1 Pro and a full 100-plus frames per second in the games we tested. But even if you're not playing Resident Evil Village, the M2 MacBook Pro will give your graphic work a nice boost.

2. YOU WANT THE FASTEST WI-FI NOW

The 14-inch and 16-inch MacBook Pro are Apple's first laptops with the next-gen Wi-Fi 6E, which brings the advantage of the spacious 6GHz spectrum with more antennas and less interference. With a Wi-Fi 6E router, the new MacBook Pros should feel speedier all around. And since it'll probably be a few years before Wi-Fi 7 appears on a MacBook, you'll get a bit of futureproofing too.

3. YOU'RE RUNNING OUT OF MEMORY

When Apple launched the M1 Pro and Max MacBook Pros in 2021, they had the same 64GB RAM ceiling as the 2019 Intel model. Of course, that's a lot of memory and way more than most people would ever need, but the MacBook Pro isn't made for casual users. So, if 64GB wasn't enough for you, the new MacBook Pro with an M2 Max that has a 38-core GPU offers up to 96GB of memory. It'll cost you at least £4,000, but you'll never see the dreaded application memory dialog box again.

4. YOU WANT THE MOST BATTERY LIFE

The biggest advantage Apple silicon has over Intel isn't speed, it's battery life. With extremely high performance per watt, Apple has managed to deliver the best of both worlds – incredible power with tremendous battery life, with the M1 models getting up to 21 hours of battery life on a single charge. And the new models somehow improve on that, squeezing an extra hour of juice out of the M2 chips (and even more in our testing).

5. YOU WANT A BETTER MULTI-DISPLAY SET-UP

When the M1 Pro and Max MacBook Pros arrived they offered more than just a speed boost over the vanilla M1 laptops. Where you could only

attach a single external display with up to 6K resolution at 60Hz with the M1, the M1 Pro upped the support to two and the M1 Max models let you connect four using HDMI and Thunderbolt. But HDMI itself was limited to just one display with up to 4K resolution at 60Hz. With the M2 Pro's HDMI 2.1 port, you can hook up an 8K display at 60Hz or a high-refresh 4K display at 240Hz, or a 4K display at 144Hz with another 6K display at 60Hz over Thunderbolt. That's enough of an improvement to make a serious multi-display set-up that will delight your eyes.

Review: Mac mini (M2 Pro)

Price: £1,399 from fave.co/40bMGMu ★★★★☆

And then there was one. With the introduction of the new Mac mini, Apple officially sells only one Mac that still uses an Intel chip – the Mac Pro. While the low-end Mac mini got an upgrade to the M1 processor just over two years ago, Apple continued to sell the 2018 Intel-based model as a more expensive option. Apple has now updated the low-end model to the M2 and replaced that Intel-based model with a new M2 Pro Mac mini.

The M2 model gained Wi-Fi 6E and Bluetooth 5.3 and has been reduced in price from £699 to £649. It's a fine entry-level system. The M2 Pro model adds two additional Thunderbolt 4 ports (for a total of four), upgrades the HDMI port to HDMI 2.1 (bringing support 4K at 240Hz and 8K at 60Hz), and has a more powerful processor. It starts at £1,399.

That £1,399 entry-level price gets you a cut-back version of the M2 Pro that has only a 10-core CPU (6 performance cores, 4 efficiency cores) and a 16-core GPU. To get the full M2 Pro with 12 CPU cores (eight performance, four efficiency) and 19 GPU cores, you have to pay an extra £300. You'll also get only 512GB of storage in that £1,399 model, which is a bit on the low side for that price. The jump to 1TB costs another £200. Add those two minimal upgrades together and you're looking at £1,899 for the full M2 Pro, 16GB of RAM, and 1TB of storage. That's the configuration we tested here.

The Mac mini's design hasn't changed in a decade, but at least it has HDMI 2.1 now.

A FEW UPGRADES, BUT NO DESIGN CHANGES

It's nice to see Apple jump aboard the Wi-Fi 6E bandwagon with its new Mac minis, and the upgrade to Bluetooth 5.3, while not currently being used for anything you can't do with Bluetooth 5.0, is a nice bit of future-proofing. Even better is the M2 Pro version's two additional Thunderbolt 4 ports, for a total of four, and HDMI 2.1, which supports resolutions of up to 8K at 60Hz or 4K at 240Hz. However, keep in mind that resolution and refresh rate start to become limited if you hook up two Thunderbolt displays at the same time. The maximum is three displays, two Thunderbolt 6K at 60Hz, and one HDMI 4K at 60Hz.

But that's where the upgrades end. The rumour mill teased a design refresh that we didn't get, and while it doesn't necessarily need one, some colours like the M1 iMac would have been nice. We'd even just take a Space Grey option, but no, the only available colour is still silver.

Worse, we've been spoiled by the completely sensible decision to put a couple of USB-C ports and an SDXC

card slot on the front of the Mac Studio. That's the kind of user-friendly update we would have liked in a new Mac mini, and it feels weird that it's not there.

CPU PERFORMANCE

The jump from Intel to Apple Silicon is notable, but you'd be crazy to compare the old Intel Mac mini to its replacement. That system hadn't been updated in over four years, and its best processor was a Core i7-8700B. That's a mobile-oriented CPU from Intel's 8th-generation Coffee Lake architecture, which wasn't even all that new at the time (the latest is the 13th generation). You can find an old review of that system here, and marvel at how Apple hasn't made a meaningful design change since around 2010.

If you're curious how the regular M2 version of the Mac mini performs, we didn't have one to test, but the M2 MacBook Air is probably very similar in performance. Refer to our M2 MacBook Air review (fave.co/3DfzpbN) for those numbers.

Let's start with a CPU performance benchmark, Geekbench 5.

Geekbench 5 (multi core CPU)

Mac mini (M2 Pro 12-core): 15,211
Mac Studio (M1 Max 10-core): 12,641
MacBook Pro (M1 Pro 10-core): 12,544
Mac mini (M1, 10-core): 7,735

Geekbench 5 (single core CPU)

Mac mini (M2 Pro 12-core): 1,947
Mac Studio (M1 Max 10-core): 1,771
MacBook Pro (M1 Pro 10-core): 1,778
Mac mini (M1, 10-core): 1,753

Apple promised up to 20 percent better CPU performance with the M2 Pro and M2 Max, and at least in multicore Geekbench 5 tests, they more or less nail it. Chalk that up to having four efficiency cores instead of two as in the M1 Pro and M1 Max, along with tweaks to clock speeds. Single-core performance is about 10 percent better.

Moving on to Cinebench (which uses the CPU for offline 3D ray-traced rendering), we see a similar situation.

Cinebench (multi core CPU)

Mac mini (M2 Pro 12-core): 14,809
Mac Studio (M1 Max 10-core): 12,388
MacBook Pro (M1 Pro 10-core): 12,381
Mac mini (M1, 10-core): 7,827

Cinebench (single core CPU)

Mac mini (M2 Pro 12-core): 1,651
Mac Studio (M1 Max 10-core): 1,538

MacBook Pro (M1 Pro 10-core): 1,531
Mac mini (M1, 10-core): 1,524

One core is about 8 percent faster, while all 12 cores beat the 10-core M2 Pro and M2 Max by roughly 20 percent.

The HandBrake video converter is a test of CPU performance or the specialized video hardware, depending on how it is configured. We transcode the 4K version of the royalty-free Tears of Steel video to H.265 using the CPU and the video encoders (the 'VideoToolbox' framework version).

The new Mac mini provides excellent performance.

Handbrake 1.4 video encode (H.265 x265)

Mac mini (M2 Pro 12-core): 503
Mac Studio (M1 Max 10-core): 1,564
MacBook Pro (M1 Pro 10-core): 675
Mac mini (M1, 10-core): 1,709

Handbrake 1.4 video encode (H.265 Video ToolBox)

Mac mini (M2 Pro 12-core): 153
Mac Studio (M1 Max 10-core): 187
MacBook Pro (M1 Pro 10-core): 190
Mac mini (M1, 10-core): 274

When using the CPU to encode, we handily outpace laptops that get hot and throttle but are only around 10 percent faster than an M1 Max. When using the video encoders, that speeds up to around 18 percent faster.

And it's not a CPU test, but this is as good a place as any to put the results of a quick storage benchmark. The Blackmagic disk speed test (fave.co/3JklpRK) is a simple quick free test anyone can run to measure read and write performance of their storage, aimed at video production needs.

Blackmagic Disk Test (read)

Mac mini (M2 Pro 12-core): 5,057
Mac Studio (M1 Max 10-core): 5,468
MacBook Pro (M1 Pro 10-core): 5,797
Mac mini (M1, 10-core): 2,850

Blackmagic Disk Test (write)

Mac mini (M2 Pro 12-core): 6,198
Mac Studio (M1 Max 10-core): 6,356
MacBook Pro (M1 Pro 10-core): 5,321
Mac mini (M1, 10-core): 2,371

The SSD performance has about doubled since the first M1 days but has remained in the 5- to 6GB/s range since. These are exceptionally good performance numbers; Apple does not mess around when it comes to storage performance.

GPU PERFORMANCE

Apple says the GPU is up to 30 percent faster than that found in the M2 Pro. Some of that is owed to architectural improvements such as cache improvements, and some is just because there are more GPU cores. In this case, the M2 Pro has 19 cores while the M1 Pro had 16.

There aren't a lot of high-end games for the Mac, and even fewer with good repeatable benchmarking tools. Still, it's nice to see Rise of the Tomb Raider running at 1080p with the High preset at well over 100 frames per second.

Rise of the Tomb Raider: 1,920x1,200 (High)

Mac mini (M2 Pro 12-core): 118fps
Mac Studio (M1 Max 10-core): 115fps
MacBook Pro (M1 Pro 10-core): 87fps
Mac mini (M1, 10-core): 30fps

Rise of the Tomb Raider: 1,280x800 (Medium)

Mac mini (M2 Pro 12-core): 160fps
Mac Studio (M1 Max 10-core): 158fps
MacBook Pro (M1 Pro 10-core): 120fps
Mac mini (M1, 10-core): 73fps

Civilization VI: 1,920x1,200 (High)

Mac mini (M2 Pro 12-core): 71fps
Mac Studio (M1 Max 10-core): 86fps
MacBook Pro (M1 Pro 10-core): 50fps
Mac mini (M1, 10-core): 41fps

Civilization VI: 1,280x800 (Medium)

Mac mini (M2 Pro 12-core): 95fps
Mac Studio (M1 Max 10-core): 86fps
MacBook Pro (M1 Pro 10-core): 66fps
Mac mini (M1, 10-core): 59fps

That's actually more than a 30 percent improvement, but CPU performance plays a factor here as

well (especially since these are games optimized for Intel CPUs running with Rosetta translation). It's interesting how similar the M1 Max performs despite having 32 GPU cores, but these older titles with Rosetta translation are perhaps limited by CPU performance as well.

Geekbench has a GPU benchmark that stresses using the GPU for general-purpose computing (like face recognition or edge detection) rather than drawing 3D graphics.

Geekbench 5 Compute (Metal)

Mac mini (M2 Pro 12-core): 51,924
Mac Studio (M1 Max 10-core): 69,676
MacBook Pro (M1 Pro 10-core): 42,862
Mac mini (M1, 10-core): 22,841

Geekbench 5 Compute (OpenCL)

Mac mini (M2 Pro 12-core): 45,476
Mac Studio (M1 Max 10-core): 60,667
MacBook Pro (M1 Pro 10-core): 37,330
Mac mini (M1, 10-core): 19,706

The M2 Pro is about 20 percent faster here, but can't keep up with the M1 Max and its 32 GPU cores.

Our iMovie tests, in which we stabilize and export a 4K home movie, stress the video encoding hardware more than anything else, but the Stabilize function hits the Neural Engine and CPU pretty hard.

iMovie 4K video toolbox: Export 4K file Best (ProRes)

Mac mini (M2 Pro 12-core): 56
Mac Studio (M1 Max 10-core): 41
MacBook Pro (M1 Pro 10-core): 66
Mac mini (M1, 10-core): 123

iMovie 4K video toolbox: Export 4K file (High)

Mac mini (M2 Pro 12-core): 276
Mac Studio (M1 Max 10-core): 156
MacBook Pro (M1 Pro 10-core): 271
Mac mini (M1, 10-core): 284

iMovie 4K video toolbox: Stabilize shaky video

Mac mini (M2 Pro 12-core): 170
Mac Studio (M1 Max 10-core): 195
MacBook Pro (M1 Pro 10-core): 231
Mac mini (M1, 10-core): 334

The M1 Max has two video encoding engines, so the M2 Pro can't keep up with its exporting speed, and the M2 Pro is similar in performance to the M1 Pro. But the faster CPU and Neural Engine in the M2 Pro make it faster than the M1 Max when applying the video stabilizing feature.

We'd appreciate some colour, but we wish even more for those front USB-C ports and SDXC slot from the Mac Studio.

VERDICT

The M2 Pro is about what we'd expect, performance-wise. Take the gap between the M1 and M2 and apply that to the M1 Pro and there you have it – a better Neural Engine, and usually somewhere between 10 percent and 20 percent better performance depending on what the limiting factors are. It's a nice upgrade from the M1 Pro and obviously a lot better than the M2. It goes without saying it absolutely smokes the Intel-based Mac mini it replaces, but that system was so old that we don't even use the same tools to benchmark it anymore.

If there's a problem with this system, it's the price. £1,149 was a good starting price for an upper-tier Mac mini, it's a real shame it went up so much to £1,399. With the lower-tier M2 Mac mini starting at a lower £649 price, the gap is bigger than ever.

And anyone considering the M2 Pro Mac mini probably won't want the £1,399 model, which only has two CPU cores and three GPU cores disabled, along with only 512GB of storage. They'll want to jump up to the full M2 Pro for another £300 and a 1TB SSD for £200 for a grand total of £1,899.

Consider that the entry-level Mac Studio is £1,999 and has an M1 Max with a 24-core GPU, double the memory bandwidth, and double the RAM (32GB versus 16GB). Plus, it's got two USB-C ports and an SDXC slot up front. The only real advantage of the M2 Pro Mac mini is Wi-Fi 6E and HDMI 2.1.

Unless Apple drastically increases the Mac Studio price when it gets an M2 Max upgrade, that will definitely

be the better buy. The starting price is just one issue; the other, as always, is Apple's exorbitant price on storage and RAM upgrades. Charging £400 to go from 16GB to 32GB of RAM, and £200 to go from a 512GB SSD to 1TB, is more than double the going retail rate for top-tier PC hardware. We're used to Apple charging a big premium for this stuff, but it's got out of hand, and the fact none of it is upgradeable and you have to buy what Apple sells you at its crazy marked-up price only makes things worse.

I mean, the 14-inch MacBook Pro with the same M2 Pro starts at just £750 more than the Mac mini and it's a whole laptop, with an HDR display, keyboard, trackpad, SDXC card slot, battery…

The M2 Pro Mac mini is a really nice machine. Super compact, silent, fast – a welcome replacement for the Intel-based model of yesteryear. Apple finally embraced Wi-Fi 6E and HDMI 2.1, too. The price represents a poor value, though, even among Apple hardware. Had Apple kept the £1,149 starting price and offered slightly more reasonable upgrade pricing, it might have been a different story. At these prices, however, either wait for a refurbished unit or spring for the Mac Studio. **Jason Cross**

SPECIFICATIONS

- macOS Ventura
- M2 Pro processor
- 10-core CPU with 6 performance cores and 4 efficiency cores
- 16-core GPU
- 16-core Neural Engine
- 200GB/s memory bandwidth
- 16GB RAM (configurable to 32GB)
- 512GB of SSD storage (configurable to 1TB/2TB/4TB/8TB)
- HDMI
- 2x Thunderbolt 4 ports
- 2x USB-A
- Ethernet
- 3.5mm headphone jack
- Built-in speaker
- 802.11ax Wi-Fi 6E
- Bluetooth 5.3
- 197x197x35.8mm
- 1.28kg

Opinion: Mac mini upgrade pricing makes no sense next to the Mac Studio

The same £1,999 gets you either an M2 Pro or M1 Max chip with identical RAM and storage. **Jason Cross** reports

Apple finally updated the Mac mini, with the new high-end M2 Pro version replacing an absolutely ancient Intel model.

It fills an important gap in Apple's Mac desktop line-up. The M1 Mac mini was cheap and got even cheaper with its M2 upgrade and the Mac Studio is powerful but expensive, starting at £1,999. Then there's the good iMac for £1,599, which is really just an M1 built into a colourful 24-inch display.

So if you want a desktop Mac, you were forced to go low-end or high-end. With the Mac mini (M2 Pro), there's finally something in-between. It starts at £1,399 for a cut-back version of the M2 Pro with a 10-core CPU and 16-core GPU. Upgrade to the full M2 Pro with a 12-core CPU and a 19-core GPU, and add a

little RAM or storage, and you find yourself spending as much as the £1,999 entry-level Mac Studio.

So who should buy the upgraded M2 Pro Mac mini and who should just get the entry-level Mac Studio? After using both for the past week, the answer isn't very clear.

IT'S COMPLICATED

The £1,699 Mac mini with a full M2 Pro chip often delivers CPU benchmark scores about 15 to 20 percent higher than the M1 Max, thanks to two additional high-efficiency CPU cores and higher clock speeds. But the £1,399 Mac mini has an M2 Pro with the same 10 cores as the M1 Max Mac Studio.

Unless you run the kind of tasks that hammer on the CPU for minutes at a time while you stare at a progress bar, you're unlikely to notice the difference. Both machines have such fast storage and memory that everyday tasks – email, web browsing, productivity work, photo editing, even light consumer-grade video editing – feel similarly fast and responsive.

The M1 Max in the base-model Mac Studio comes with 32GB of RAM, while the M2 Pro starts with 16GB. Frankly, 16GB is fine for most things, but if you need to run a lot of applications at once or really big content creation workloads, the extra RAM will make a difference. And if you plan on keeping it for five years or so, the extra RAM is nice to have.

When comparing the GPU in the M2 Pro to the M1 Max, it gets complicated. The M1 Max in the base model Mac Studio has 24 cores, with 32 cores available for an extra £200. The M2 Pro has 16 cores, with 19 cores for an extra £300. The Mac Studio will usually outperform the Mac mini here since it's got 50 percent more cores and double the memory bandwidth.

In other words, for everyday browsing and such you're not likely to notice much difference with either machine. For sustained intensive CPU operations, the M2 Pro Mac mini can outperform the Mac Studio slightly, but even then only if you spend £300 on a CPU upgrade. There aren't a lot of tasks whose bottleneck is the Neural Engine, but it's considerably faster in the M2 Pro, at least on paper.

At the end of the day, I'd take even the entry-level M1 Max with 24 CPU cores and 32GB of RAM over the full-strength M2 Pro, but it's close.

Those front ports make the Mac Studio a much more user-friendly design.

IT'S NOT JUST THE PROCESSOR

But there's more to these machines than the difference in processor power. The Mac Studio is obviously bigger – it's about 2.5 Mac minis stacked on top of one another. But both machines have the same footprint. They're just tiny by modern desktop computer standards and nearly silent.

Design-wise, I prefer the Mac Studio. The extra height doesn't bother me… in fact, it makes a great monitor stand for the Studio Display. But it's the two USB-C ports and SDXC card slot on the front that make me love the Mac Studio. I used them regularly, and I immediately missed having them on the Mac mini.

The Mac mini has Wi-FI 6E, which might matter if you've got a Wi-Fi 6E router or plan to buy one soon, though the Wi-Fi 6 on the Mac Studio is by no means slow. The mini also has HDMI 2.1, a serious game-changer if you want to hook your Mac up to an 8K monitor or a 4K monitor at greater than 60Hz.

While the HDMI 2.0 port is a little bothersome on such an expensive computer, it's the front ports that make me lean toward the Mac Studio. You might eventually notice the performance boost of Wi-Fi 6E or on rare occasions need an HDMI 2.1 port, but you'll use those front USB-C and SDXC slots almost every day.

If you need to spend no more than £1,600, the base model Mac mini with a storage upgrade to 1TB isn't bad. It's a bit overpriced, but it's still far enough below the Mac Studio price to be worth it.

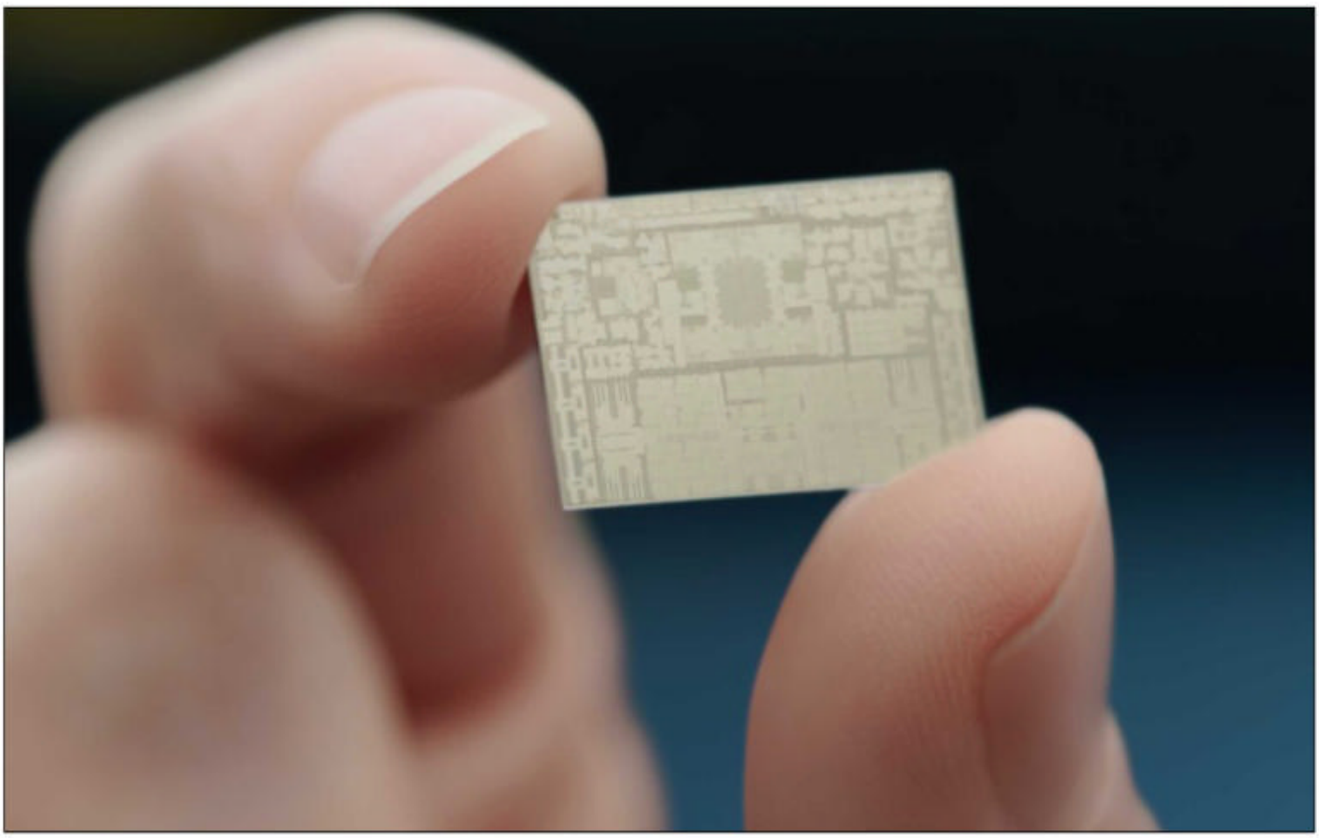
But the more you upgrade the Mac mini to match the Mac Studio, the worse the match-up gets. While the Mac Studio's upgraded 32-core GPU costs £200, you'll need to add £300 for the full M2 Pro Mac mini.

Add £400 to jump to 32GB of RAM to match the Studio and you're at £1,999. Consider the fact that you'll need to spend £100 to upgrade the Mac mini's Gigabit Ethernet port to the 10Gb Ethernet port that's standard on the Mac Studio and the Mac mini technically costs more. Oh, and don't forget those front-facing USB-C ports and SDXC card slot.

So, which would you rather have for £1,999: an M2 Pro with 32GB of RAM and a 512GB SSD, Wi-Fi 6E and HDMI 2; or an M1 Max with 32GB of RAM and a 512GB SSD, and front-facing USB-C ports and an SDXC card slot? The Mac mini with M2 Pro should really start at £1,149 and of course, Apple's long-standing ridiculous prices on upgraded RAM and storage are to blame here, too.

And then there's the next generation of the Mac Studio. We haven't heard much about an upcoming M2 Max M2 Ultra-based Mac Studio, but the M1 version is almost a year old, and with the M2 Max now available in the MacBook Pro, we're only waiting on an M2 Ultra. Assuming the Mac Studio updates this spring with the Mac mini's HDMI 2.1 and Wi-FI 6E upgrades, and Apple doesn't increase the price, there will be no reason whatsoever to recommend an upgraded M2 Pro Mac mini at all.

But for now, if you're looking for a Mac desktop a bit more powerful than the regular M2 model, grit your teeth and grab the £1,399 Mac mini, possibly with a 1TB storage upgrade if you can swing the £200. But if you consider upgrading anything else – the processor or the RAM – I think most users would be happier and get more for their money, with the £1,999 Mac Studio.



Before you buy a new M2 Pro or M2 Max Mac, here are 5 key things to know

We knew they would be faster, but what else did Apple deliver with its new chips. **Jason Cross** reports

The march of Apple silicon is not slowing down. To power the new high-end Mac mini and 14- and 16-inch MacBook Pro systems, Apple has unveiled the all-new M2 Pro and M2 Max processors, taking all the improvements of the A15 and A16 processors and applying them to the Mac chips, resulting in a significant boost in performance over the M1 line. Apple claims the M2 Pro and M2

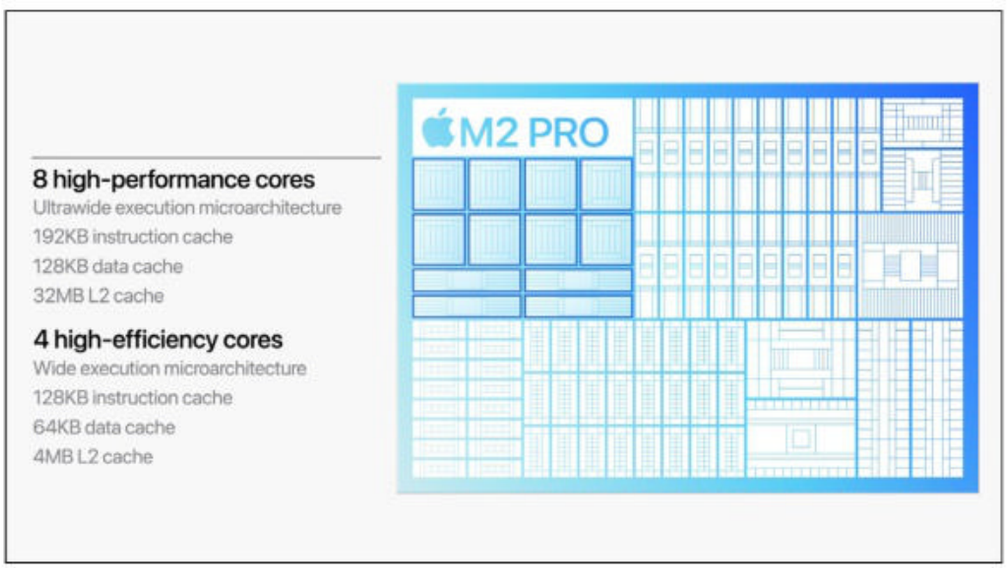
Max chips bring 20 percent better CPU performance and 30 percent faster GPU performance than the M1 Pro and M1 Max. They also include the newer Neural Engine, which is up to 40 percent faster than that in the M1 series.

As impressive as those claims are, they are also unsurprising and a bit disappointing. Some of the more exciting rumours about more advanced manufacturing, new GPUs, or other improvements have proven untrue, and the M2 Pro and M2 Max appear to be exactly what was expected: the M2 scaled up with more CPU and GPU cores and a wider memory bus. In fact, the M1 Pro and M1 Max chips had more to differentiate them from the M1 than the M2 Pro and M2 Max do when compared to the M2.

But still, there are some interesting things to know about these chips before you decide to buy one of the new Macs. Here are five key characteristics worth noting.

1. SAME CPU CORE DESIGN AND PERFORMANCE AS M2

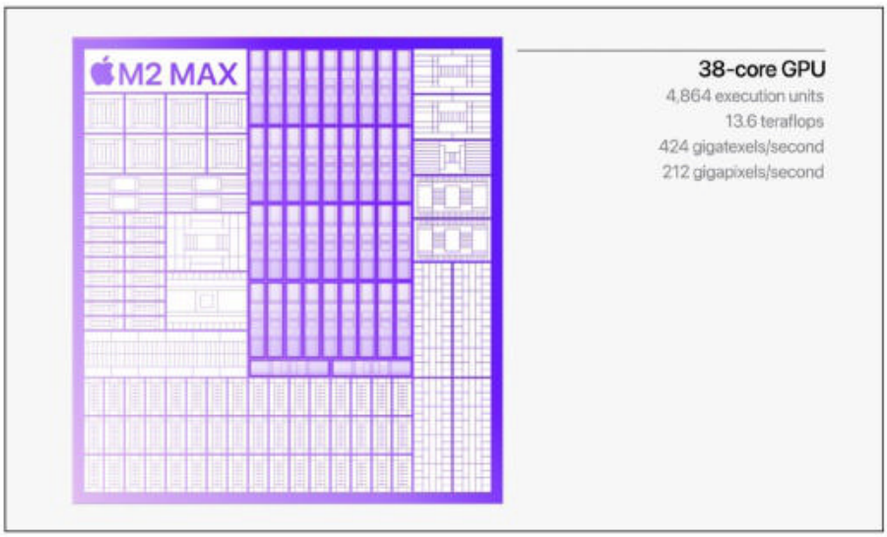
When Apple introduced the M2, it claimed an 18 percent improvement in CPU performance versus the M1. Now it's saying that the M2 Pro and M2 Max have 20 percent better CPU performance than the M1 Pro and M1 Max, and leaked benchmarks (fave.co/406YK1m) seemed to back up those claims. In other words, you can expect the same overall architectural improvements and performance uplift as the M2 delivered compared to the M1.



The CPU seems identical to the M2, only with double the high-performance cores.

Some of this simply comes down to core count.

The M2 Pro and M2 Max have eight high-performance cores just like the M1 Pro/Max, but the number of efficiency cores goes up from two to four. So the M2 Pro and M2 Max have 12-core CPUs while the M1 Pro/Max have 10-core CPUs.



That's a big GPU with an odd number of cores, but where's the ray-tracing support?

2. GPU GAINS ARE BETTER, BUT THERE'S NO GREAT ARCHITECTURAL SHIFT

Apple says the M2 Pro/Max GPUs are 30 percent faster than the M1 Pro/Max, and leaked Metal benchmarks (fave.co/3Y0gjyj) back up those claims. That's unsurprising, considering the M2 was said to have graphics performance that is up to 35 percent greater than the M1.

This is likely due to the addition of a few more graphics cores and some minor architectural tweaks. The M2 Pro has up to 19 graphics cores (versus 16 in the M1 Pro) and the M2 Max has up to 38 graphics cores (versus 32 in the M1 Max).

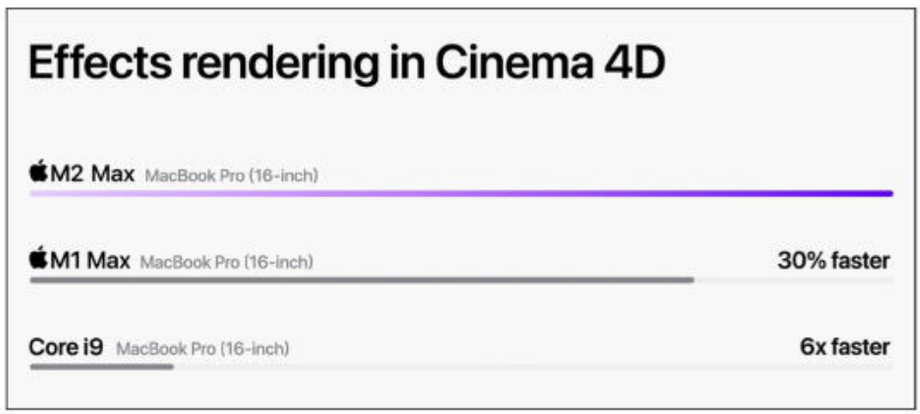
Those are unusual numbers – core counts are typically even in number, and often powers of two, so it's likely that the design is for 20/40 GPU cores with room for one faulty core to be disabled, improving manufacturing yields on these big chips. Still, that's a nearly 20 percent increase in core count, so with some improved caching and higher clock speeds, you can get to 30 percent.

If you were hoping for an all-new GPU from Apple with modern features like ray-tracing acceleration, which GPUs from AMD and Nvidia have had for several years already, you're going to be disappointed.

3. MEMORY BANDWIDTH IS THE SAME EVEN WITH MORE RAM

Memory bandwidth on the M2 Pro is 200GB/s, just like the M1 Pro. The

M2 Max doubles that to 400GB/s. So we're almost certainly still looking at a 256-bit LPDDR5 memory bus on the Pro and 512-bit LPDDR5 on the Max. Apple improved caching in the A15, and those architectural improvements likely carry over to the M2 Pro and M2 Max.



We can't help but notice that Apple's marketing benchmarks around video are all GPU-limited activities, not encoding performance.

While the M2 Pro maxes out at 32GB of RAM (the same as the M1 Pro), the M2 Max can go up to 96GB – 50 percent more than the 64GB limit of the M1 Max. But there's a catch – the 96GB RAM option is limited to the version of the M2 Max with 38 GPU cores. The less expensive option with 30 GPU cores tops out at 64GB.

4. THEY STILL DON'T HAVE AV1 SUPPORT

With the M1 Pro had a new video encoder and decoder that added hardware acceleration for the ProRes format, and the M1 Max doubled the number of video encoders to two. After some confusion, that's still the case with the M2 Max, but it supports all the same formats as before: H.264, HEVC, ProRes and ProRes RAW. That means support for the newer AV1 codec is still nowhere to be found, despite being available in today's GPUs from Nvidia, AMD, and Intel. Apple is falling behind here.

We couldn't help but notice that all of Apple's marketing benchmarks around video production, claiming improvements of 30 percent or so, are for activities like colour grading or 3D effects rendering, typically limited by GPU performance. Apple didn't provide benchmarks showing an improvement in video encoding speed, so it will be interesting to watch the first reviews of the M2 Max to see if the video encoders are measurably faster.

5. THEY'RE STILL ALL 5NM

There has been a lot of speculation about when Apple will start using TSMC's new 3nm manufacturing process. Apple is said to be the first major manufacturer to do so, and some of the rumours said the new M2 Pro and Max chips would be where Apple makes the leap.

It looks like we'll be waiting for an M2 Ultra later in the year, or possibly the A17 that will be introduced with the iPhone 16 this fall. Apple says the M2 Pro and Max are made using "second-generation 5nm technology". It's likely that this is the same process that Apple somewhat erroneously called "4nm" in its iPhone 15 presentation in September 2022. TSMC calls its N4 node an "enhanced" 5nm process, and Apple seems to be correcting its language here.

M2 Pro versus M2 Max: It comes down to memory – and money

The M2 Pro and Max are in some ways identical and also very different. **Jason Snell** reports

With the release of the 2023 MacBook Pro and the 2023 Mac mini, the shape of the second generation of Apple silicon on Mac has been revealed. It is, unsurprisingly, a bit of a replay of the first generation: Apple has segmented its chips into a few different varieties.

As with the M1 generation, the new M2 Pro and M2 Max chips are closely related to each other and to the M2 chip introduced last summer. They're all based on the same foundation, but each chip has some different

characteristics. When it comes time to choose how much to pay for a Mac mini or a MacBook Pro, those differences matter.

BUT FIRST, THE M2

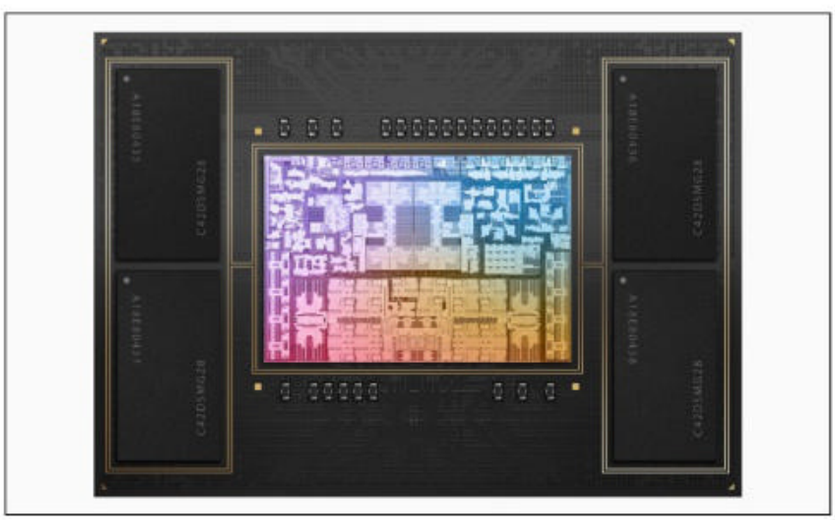
Before I compare the M2 Pro and M2 Max, it's only right to discuss the M2, which debuted last June with the MacBook Air and 13-inch MacBook Pro. The CPU and GPU cores in the M2 are the same ones found in Apple's A15 chip, which formed the basis of the iPhone 13 line.

Apple's chips keep getting incrementally faster. In general, each M2 CPU core is about 12 to 15 percent faster than the equivalent M1 core. As a result, the M1-to-M2 transition can't provide the quantum leap offered by Apple's jump from Intel to its own processors. Instead, the Mac is now on the slow-but-steady progress path that we see every year with the unveiling of a new iPhone processor.

However, Apple does keep tinkering around the edges from generation to generation. In the M2, Apple addressed one of the biggest failings of the M1 processor: limited RAM capacity. The M2 can support up to 24GB of unified memory, up from the 16GB limitation that made a lot of prospective M1 Mac buyers wince. Apple also increased memory bandwidth from 68- to 100GB/s.

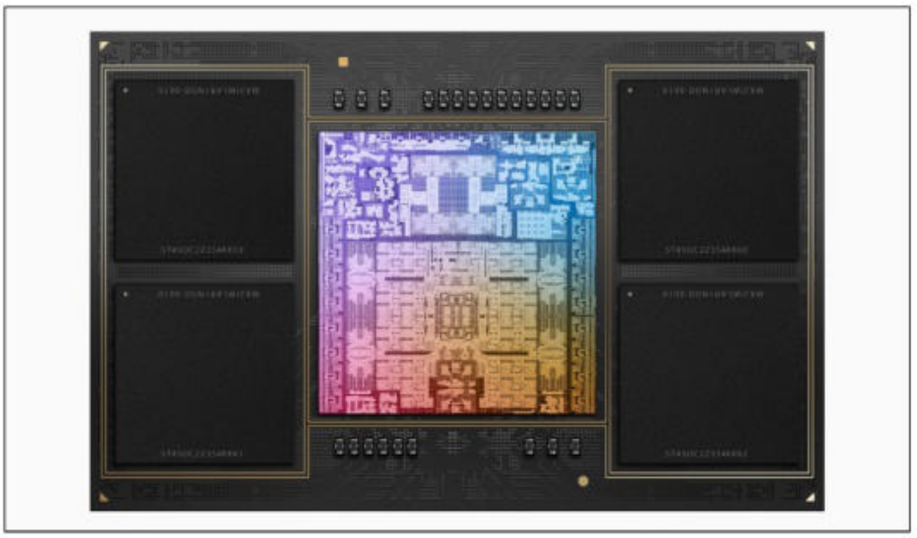
While the M2 kept the same CPU core configuration of the M1 – eight cores, four devoted to performance and the other four to efficiency – it increased the maximum number of GPUs available on the chip from eight to ten, boosting maximum graphics performance a bit. The next-generation Neural Engine on the M2 is more than 40 percent faster at machine-learning operations.

Perhaps most significantly, the M2 offered a boost to video encoding. In the previous chip generation, Apple added dedicated hardware to the



The M2 Pro takes the M2 and increases the CPU cores, GPU cores and memory.

high-end M1 Pro, Max, and Ultra chips to allow them to encode and decode ProRes video files much more efficiently. Apple rolled that capability into the M2, making Macs with M2 processors much more capable video editors.



The M2 Max has the same number of CPU cores as the M2 Pro, but the Max boosts the GPU cores.

The M2 is an impressive chip, but it really does pale in comparison to the M2 Pro and M2 Max. The M2's four performance CPU cores make it remarkably powerful – but the M2 Pro and Max offer twice as many, which doesn't quite double CPU performance… but it's still about 1.6 times the speed. And then there's the GPU side, where the M2's maximum of 10 GPU cores goes up against up to 19 GPU cores on the M2 Pro and a staggering maximum 38 GPU cores of the M2 Max.

And while the M2's 24GB of maximum RAM is a lot better than the M1's 16GB, the M2 Pro can go up to 32GB and the M2 Max can range as high as 96GB. Memory bandwidth on the M2 Pro is twice that of the M2, and on the M2 Max, it's four times.

Throw in limited USB/Thunderbolt ports and video-out support and you can see that there's still a lot to differentiate the high-end chips from the M2. This is not to say that the M2 is in any way a loser. It's actually a remarkably powerful chip. But Apple has designed the M2 Pro and M2 Max for a more demanding user.

PRO VERSUS MAX

As with the M1 Pro and M1 Max, it's important to note that the M2 Pro and M2 Max are identical in many ways. Apple offers M2 Pro chips with fewer than 12 CPU cores, but if you get a 12-core model you'll get exactly the same 12 cores as offered on the M2 Max. The CPU power will be identical. Don't believe me? Take a look:

Geekbench 5 (multi core CPU)

16-inch MacBook Pro M2 Max 12-core (2023): 14,607
16-inch MacBook Pro M2 Pro 12-core (2023): 15,079
14-inch MacBook Pro M1 Max 10-core (2021): 12,590
14-inch MacBook Pro M1 Pro 10-core (2021): 12,544
13-inch MacBook Pro M2 8-core (2020): 8,908

Geekbench 5 (single core CPU)

16-inch MacBook Pro M2 Max 12-core (2023): 1,981
16-inch MacBook Pro M2 Pro 12-core (2023): 1,960
14-inch MacBook Pro M1 Max 10-core (2021): 1,774
14-inch MacBook Pro M1 Pro 10-core (2021): 1,778
13-inch MacBook Pro M2 8-core (2020): 1,943

Everywhere else, the story is different. Apple has limited the M2 Pro to 19 GPU cores, but the M2 Max can have as many as 38. This means if you need graphics horsepower, the M2 Max is the way to take it to the max.

Geekbench 5 Compute (Metal)

16-inch MacBook Pro M2 Max, 38-core GPU (2023): 85,903
16-inch MacBook Pro M2 Pro, 19-core GPU (2023): 51,587
14-inch MacBook Pro 14 M1 Max, 32-cores GPU (2021): 68,534
14-inch MacBook Pro 14 M1 Pro, 16-core GPU (2021): 42,862
MacBook Air M2, 8-core GPU (2022): 30,729

Similarly, the M2 Pro's memory maxes out at 32GB, but the M2 Max can handle as much as 96GB. And memory bandwidth on the M2 Max is double that on the M2 Pro. And the M2 Max is better at video encoding at decoding because it's got two video encoding engines and ProRes video engines to the M2 Pro's one. That means that in some video encoding tasks, the M2 Max will be twice as fast, as our Final Cut Pro export showed.

Final Cut Pro (Export)

16-inch MacBook Pro M2 Max, 38-core GPU (2023): 717
Mac mini M2 Pro, 19-core GPU (2023): 1,120
MacBook Air M2, 10-core GPU (2022): 1,197

CHOOSE WISELY

You can basically think of the M2 Max as the M2 Pro with a little bit extra

– and based on Apple's photos of the chips, you can take that literally. The two chips appear identical when viewed from the top to the bottom of the M2 Pro… but the M2 Max is larger, continuing a bit beyond. In that new area, Apple's added a second bank of GPUs, an additional memory bus, and additional video-encoding engines.

So which will it be, Pro or Max? If your workflows are largely driven by CPU speed, the extra GPU cores of the M2 Max chips will not help you, making an M2 Pro a better buy. That is unless you need enormous amounts of very fast RAM, in which case, again, the M2 Max is a better choice. Video encoding will be faster on M2 Max, but perhaps not enough for it to justify the increased prices.

Opinion: Is the power of Apple silicon holding back the Mac?

Apple's incredible processors may be getting in the way of the innovation that the Mac needs. **Dan Moren** reports

Bear with me: this is, on the face of it, a weird idea. But is it possible Apple is making its Macs too powerful? Okay, , I know: how could having a computer that's too powerful be a bad thing? But after the announcement of the new MacBook Pro and Mac mini, I found myself wondering whether Apple has painted itself into a corner, vis-à-vis its impressive hardware.

It is, admittedly, a strange state of affairs when you find yourself

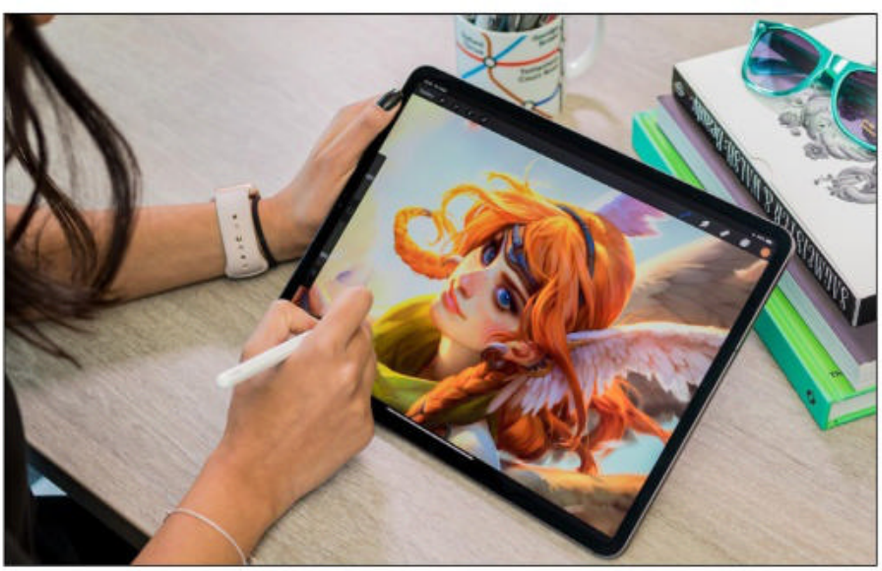
wondering if Apple has maybe become too good at making computers that are so powerful they are overkill for the purposes of most tasks, but you don't have to look too far to see another example of this same phenomenon.

This is a struggle that Apple's long contended with on the iPad. Ask any user pushing the envelope of an iPad Pro and the consensus will likely be that the hardware is awesome and incredibly powerful – if only the software could keep up.

To be fair, the problem with the iPad is more about what's available on the platform. Yes, you can have all the power of an M2 processor, but how do you really put it to use? Most iPad users aren't doing high-level video editing, coding, or working with giant Photoshop images. (That said, Apple's advertising would like to remind us that any of us could be doing all those things…if only we'd buy an iPad Pro.)

I'm not suggesting that a lack of powerful software is what's holding the Mac back: if anything, Apple's clearly committed to letting users throw as much horsepower at pro-level applications as they possibly can. And it's doing so by offering a ton of different machines powered by a slew of ever more powerful chips. When Apple announced its first post-M1 processors over the last couple of years, the rollout took on almost comical self-topping proportions as it announced first the M1 Pro and M1 Max, and then in 2022, the M1 Ultra. It felt a bit like one of those old infomercials: "But wait! There's more!"

The truth of the matter is that even the Pro series processors are way overpowered for most



The iPad is an example of the software not keeping up with the hardware. The same phenomenon could be happening with the Mac.

common computing tasks. Email, web browsing, word processing, spreadsheets – the M1 and M2 handle all of those with power to spare. And yet Apple keeps pushing out faster and faster chips, appeasing a smaller and smaller niche of the market (albeit one with high margins). Between the M2 Pro and M2 Max MacBooks, the M2 Pro Mac mini, the Mac Studio, and the still-to-be-unveiled Mac Pro, it seems like there are more machines aimed at the market for powerful professional desktops than consumers. and yet, the higher you go, the thinner the air: there are fewer people in the market for machines that powerful.

The long-standing paradigm for the computer industry is that the more you spend, the more power you get. That used to be embodied by a single spec: the clock speed of a processor. in the late 1990s and early 2000s, customers had fixated on clock speed as the only measurement that mattered – an idea Apple even attempted to dispel with its idea of 'the megahertz myth'. And, to some degree, it worked: Search Apple's specs pages or press releases for its new Macs, and you won't even see mention of the speed of any of its processors.

Instead, it's been supplanted by an alternate metric: cores, both CPU and GPU. The more money you shell out, the higher your number of parallel processing units. But even with that, we've fallen back into the trap of just blithely increasing the number, with a focus on 'bigger is better'. And just like with the megahertz myth, the fixation on cores ignores the qualities that are really making the differentiation between models for most users.

Because when all your devices are ridiculously powerful, the distinction comes down to other more tangible features: Screen size. Form factor. Number and type of ports. Heck, port placement. All of those are more readily understood by (and arguably more relevant to) the market than abstract numbers like '20 percent faster'. Sure, to a visual artist pumping out renders that eat up their entire CPU, 20 percent faster might mean saving them a day's worth of work. But nobody believes that a 20-percent faster CPU will let them answer emails so much more efficiently that they can kick off their weekend on Thursday. That's simply not the limiting factor.

With the first two generations of its own chips under its belt,

Apple has readily proved that it's capable of making hardware that is second to none. And I'm certainly not advocating that Apple not try to produce the best chips it can. But no jump in the near future is going to be as big as that first one, from Intel to Apple silicon, and as it approaches the end of this transition period, Apple might want to consider other ways to push the Mac forward – new form factors? touchscreens? – rather than just ever faster chips with more plentiful cores. In other words, to throw some of the company's most famous words back in its face, perhaps it's time to once again think different.

Apple’s Mac security is so good, it’s sending used M1 MacBooks to the scrap heap

Apple’s Activation Lock is causing headaches for third-party resellers who can’t get into used MacBooks. **Roman Loyola** reports

Apple’s efforts to protect a user’s data are a major selling point for customers. If your MacBook is stolen, it’s extremely difficult for the thief to bypass the laptop’s security measures and access the data as long as you’ve taken advantage of the tools at your disposal to lock down your machine. However, those same security measures can render a Mac

useless in a legitimate sale on the second-hand market.

A report by Vice (fave.co/3JfFCbw) highlights the frustrations of an independent computer repair specialist and refurbisher, John Bumstead, who tweeted about the "millions" of MacBooks that have been "condemned…to death" because of Apple's Activation Lock. Activation Lock associates a device with an Apple ID, and is automatically turned on when Find My Mac is activated within the Apple ID settings on your Mac. With Activation Lock active, the Apple ID username and password have to be entered to gain access to the Mac, even if it has been erased.

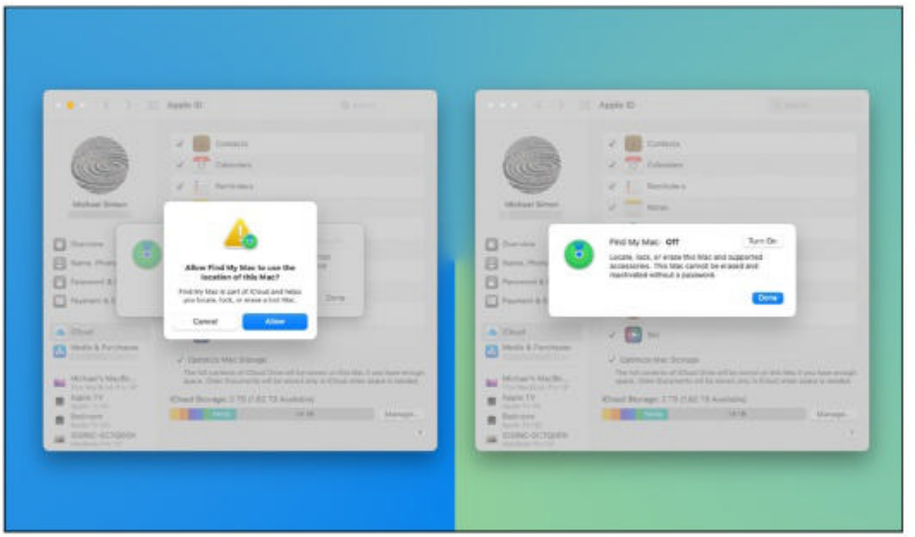
Hey @tim_cook @apple, why have you condemned this beautiful M1 MacBook and millions like it to death? Its battery has only 4 load cycles, and it wants to LIVE! #righttorepair #activationlock pic.twitter.com/R2Mr2PeTCH
John Bumstead (@RDKLInc)
January 22, 2023

Bumstead told Vice that Apple's security is "formidable" and has become practically impossible to jailbreak or bypass on Apple's M-series Macs. The T2 security chip that Apple introduced on Intel Macs in 2018 is now integrated into the M1 and M2 system on a chip and if it's not properly deactivated, it's causing Macs that are less than two years old to be scrapped and stripped for parts.

Activation Lock has long been a problem for third-party resellers, as well as individuals involved in a legitimate transaction. As Bumstead points out, if Find My Mac hasn't been disabled, devices can't be used even though they are in good working condition. Users can turn off Find My Mac in the Apple ID settings of the Mac, but that also shuts off the ability to locate it. Activation Lock can't be toggled on or off separately.

Bumstead wants Apple to be more active in helping people who are legitimately trying to access a device. He suggests that a user could make a request to access a machine and then Apple could "explore its records" and "query the original owner", and if everything checks out "and the original owner does not protest within 30 days", the restrictions can be lifted so the device can be used again.

Apple has a way online to request that Activation Lock be turned off



To disable Activation Lock on your Mac, you need to turn off Find My Mac.

(fave.co/40asw58), but it involves performing a check of the device's serial number against the registered owner, which means that the second owner needs to be able to work with the original owner to get the request fulfilled. In some instances, that's difficult or impossible to do.

It's important that if a device is being sold second-hand, the Apple ID must be disassociated from it. If you're selling a device, you can't just wipe out the drive and reinstall the operating system, you also need to disable Find My Mac and Activation Lock. If you're buying a second-hand device, confirm with the seller that Activation Lock has been disabled and the product has been disassociated with the owner's Apple ID. Also, confirm that you can contact the seller for their Apple ID info if Activation Lock kicks in and that you can return a device you can't get access to.

Apple encourages owners of older devices to participate in the company's trade-in programme (fave.co/3wD2Z7s). Eligible devices earn credit towards a purchase, while ineligible devices are recycled for free. Apple can presumably unlock Macs that are inaccessible due to Activation Lock.

MicroLED, touchscreen Macs, OLED MacBooks: Are the rumours true?

Rumours of Apple shifting to new display technologies are nothing new. Is it different this time? **Jason Cross** reports

Oh, look, another round of rumours about new Apple display technologies. These are nothing new. Apple has prioritized display quality for years, and many of its devices have some of the most colour-accurate and sharp displays in their class. On the other hand, Apple is rarely the first to adopt brand-new display technologies – it was far behind Android phones in delivering always-on displays, higher refresh rates, variable refresh rates, and so on. The MacBook Pro only got HDR and ProMotion last year.

In the past month, we've heard three new rumours about Apple

displays worth investigating. One is that Apple will start to use microLED displays beginning with the Apple Watch Ultra next year. Another is that the first MacBooks to use OLED displays are on the way as early as next year, and on a related note, touchscreen MacBooks are coming in 2025. Let's take these one at a time.

A MICROLED APPLE WATCH IS A GOOD IDEA

The idea that Apple is going to transition to microLED displays is nothing new. I wrote an article explaining microLED technology almost five years ago (fave.co/3WJAIGR) when we first heard rumours that an Apple Watch with a microLED display was coming soon.

That's right, we've been hearing about this since at least 2018. Honestly, it's a great idea. A microLED display is thinner, brighter, and more power-efficient than modern OLED displays, with faster response times. They almost look painted-on, like some sort of amazingly high-quality e-ink and you can achieve fantastically high pixel density.

The downsides of microLED are that they're expensive and difficult to build in large sizes. Samsung's got a microLED TV (fave.co/3wCgzaU), but it's one of those 'we're making 100 of these and they cost $80,000' things.

The technology is improving, becoming easier to manufacture at scale. So the Apple Watch Ultra is the perfect place for it – it's tiny and expensive, and both space and power are at a premium. Remember, the Apple Watch was the first Apple device to get an OLED display.

Will Apple make the leap? It's hard to say – we've been here before – but microLEDs have never been closer to mass market adoption. The rumour also says that Apple will make the displays 'in-house', but that's a bit of a misnomer. Upon further clarification, it appears that Apple would still work with a partner with expertise in the area, only with more control over the design, specifications, and manufacturing details than usual.

OLED MACBOOKS SEEM INEVITABLE

Here's another one we've heard for years. Most recently, analyst Ming-chi Quo (fave.co/3Yl2drB) said Apple would ship a MacBook with an OLED display by the end of 2024 "at the earliest".

OLED displays are on Apple Watch and iPhone; Macs are the only Apple devices still using LEDs. Now that OLED displays are more affordable at larger sizes, and can exceed the current MacBook Pro's display in brightness, contrast, and colour gamut within the same power profile, this is more a question of 'when' than 'if'.

These rumours have been around for a couple of years, especially in light of some premium Windows laptops that include OLED displays. It seems obvious that it's going to happen, it's just a matter of timing.

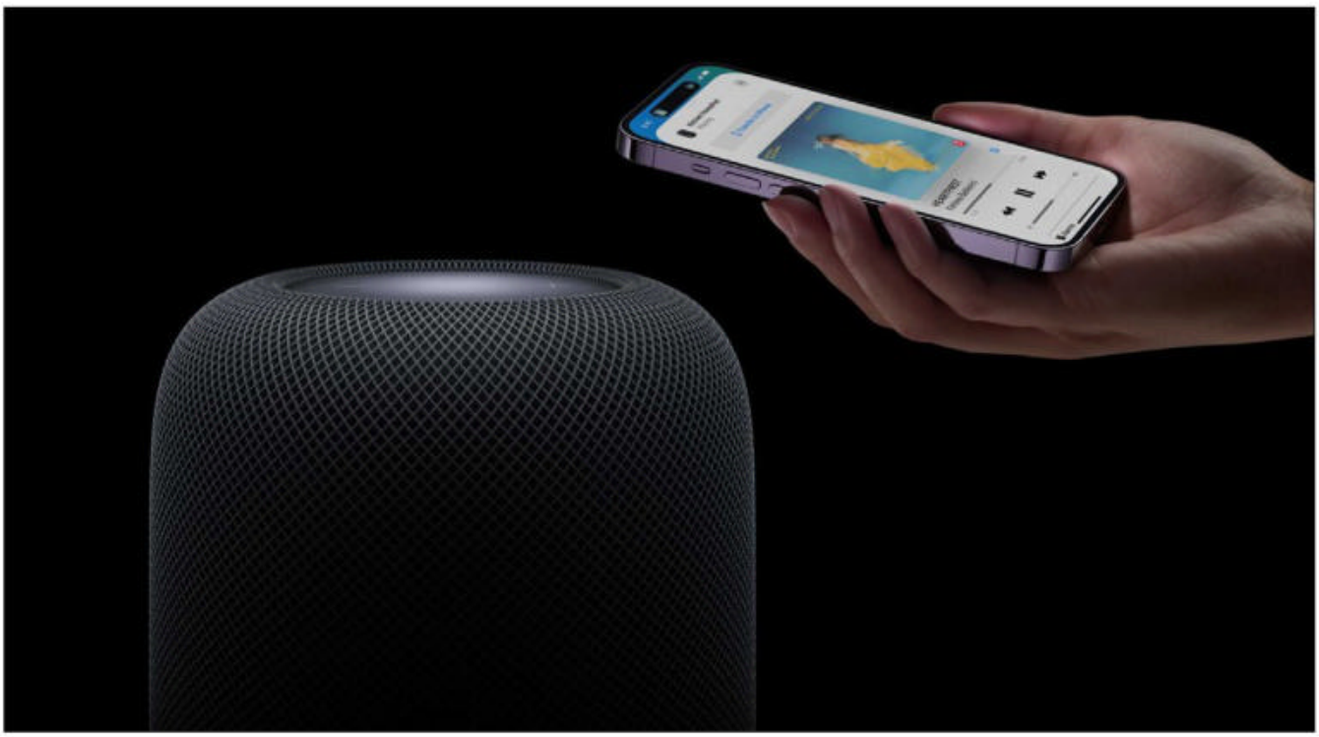
TOUCHSCREEN MACBOOKS WOULD BE A HUGE SHIFT

Coinciding with the OLED MacBook rumour is one from Mark Gurman of Bloomberg that says 2025 will see a MacBook with not just an OLED, but an OLED touchscreen. This would of course mean a complete 180 from Apple's earlier statements on the matter. Steve Jobs decried the concept, saying "your arms want to fall off" after reaching up to touch a computer's display for a while.

But we've entered a new Mac era. With Apple silicon, the chips inside are essentially similar to those found in iPhones and iPads, just bigger. Macs with Apple chips inside can run iPhone and iPad apps (many, but not all, anyway). It's not a good experience most of the time, because apps for those devices are touch-first and macOS is pointer-driven.

This one seems a little iffier. Apple has tiptoed into touch control on MacBooks with the Touch Bar, which is now absent from the latest MacBook Pros. The company's ultimate decision about whether to make a future MacBook touch-capable will probably come down to software rather than hardware. An OLED display seems like a sure thing eventually, but simply running iPad and iPhone apps more easily on your Mac doesn't seem like enough to justify a touchscreen.

Apple will have to substantially change both macOS and its homegrown apps, in addition to providing great tools for developers, to make touch-capable MacBooks really worthwhile. I have no doubt that such experiments are currently ongoing within Apple, and the ultimate call about whether to embrace touchscreens or not will come down to how successful that development and design work is.



Defying logic, Apple announces 2nd-gen HomePod for £299

The new full-size HomePod looks the same, costs the same and does much of the same as its predecessor. **David Price** reports

A day after unveiling updated Macs with M2 processors, Apple surprisingly announced another refreshed product: the return of the full-size HomePod. The original model was discontinued in March 2021 and was assumed to have sold poorly, making the decision to make a new one surprising, to say the least.

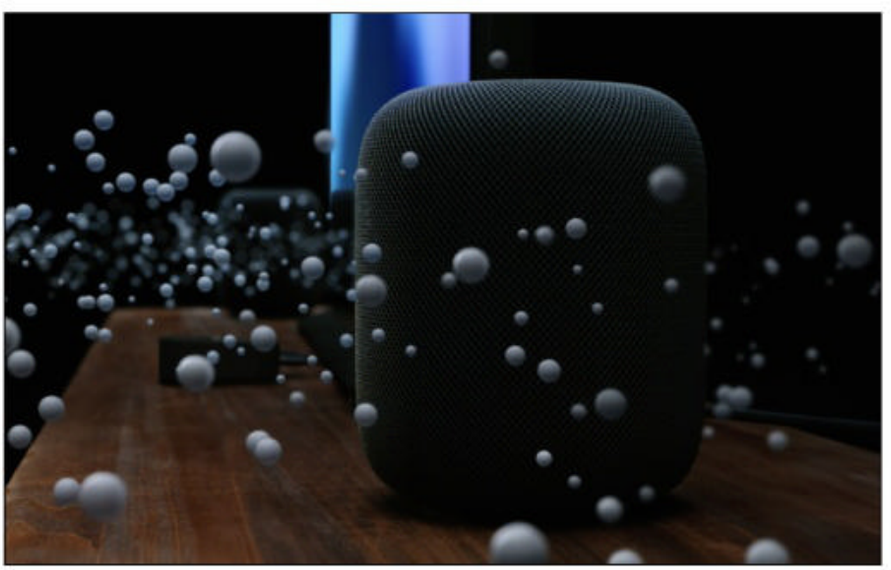
Design-wise, the new speaker appears largely unchanged from its predecessor: there's no sign, for example, of the widely rumoured screen upgrade, which a colleague points out would have made a lot of

sense with Apple Music's recently added karaoke feature. It's 4mm shorter than the original model, and roughly 200g lighter and Apple says it's now made from "a seamless, acoustically transparent mesh fabric".

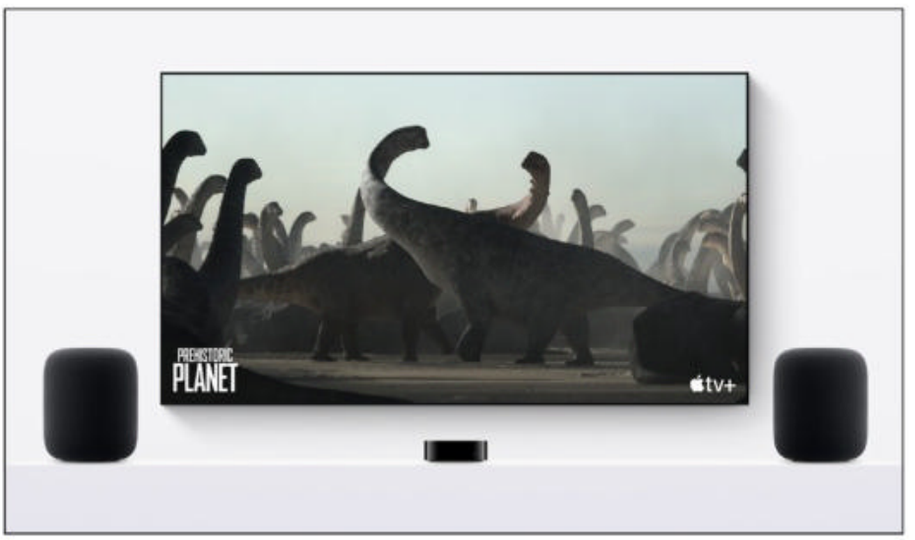
Apple hasn't even added any new colours. Like the original model, the new HomePod comes in either black (Midnight) or white, whereas the HomePod mini also offers blue, yellow and orange. Those extra colours arrived about a year after launch, however, so perhaps the new HomePod will get them in due course.

The hardware inside the attractive cylinder chassis has been upgraded, but not dramatically so from the sounds of Apple's press release. It supports Thread and gets an Ultra Wideband chip for device proximity purposes, as well as temperature and humidity sensors, but still doesn't get Bluetooth 5.3 or Wi-Fi 6e. One intriguing upgrade, however, is called Sound Recognition. This is designed to detect sounds such as smoke and carbon monoxide alarms and notify the user about them through an iPhone alert. But this feature won't be available at launch. Apple says Sound Recognition will be added in a software update in spring.

In terms of expected audio performance, it doesn't 'sound' like there's much to choose between the two generations. We'll have to test out the new HomePod before delivering a verdict, of course, but Apple doesn't claim or appear able to substantiate any great audio advances: there are two fewer "horn-loaded tweeters" and two fewer microphones than the original model, but these things are unlikely to transform the experience for audiophiles. Then again, audio quality was never the problem with the full-size HomePod,



Expect superb audio quality, but don't expect to see the sound bouncing around your room.

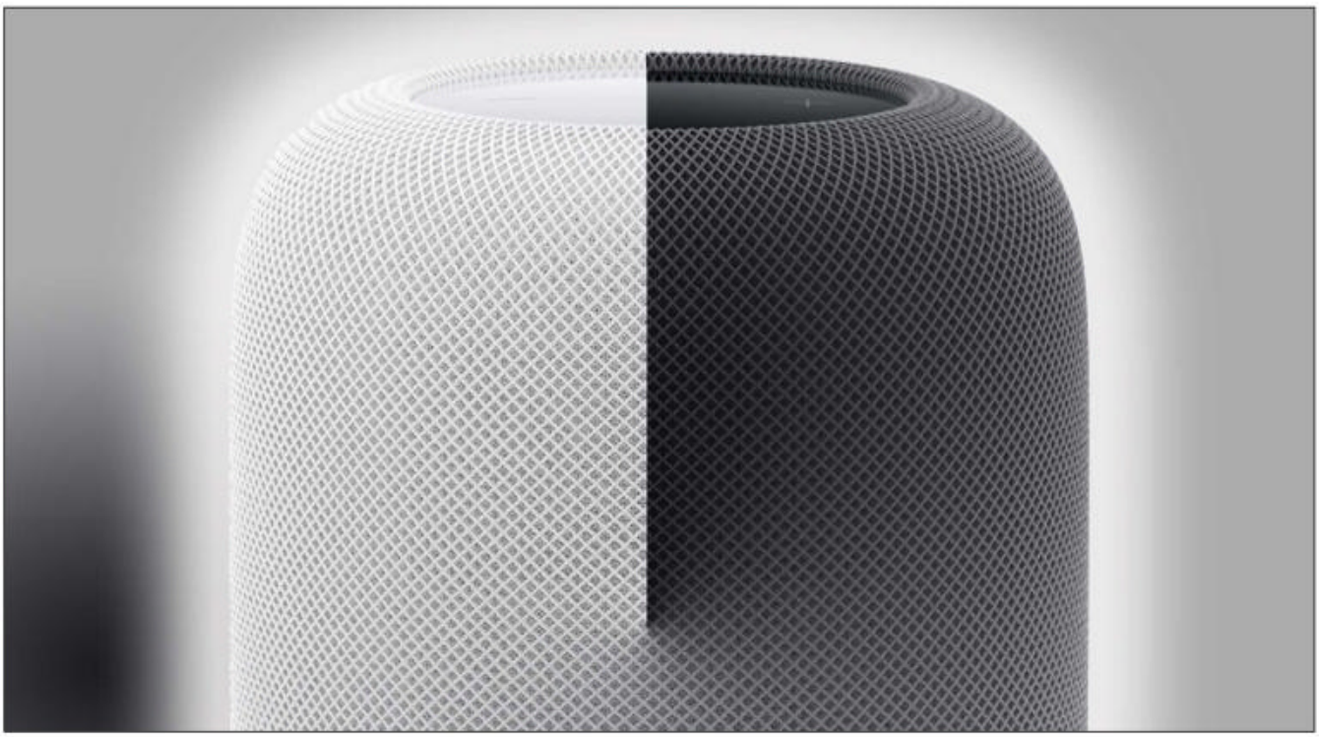


The new HomePod, like its predecessor, is designed to work as part of a stereo pair.

The second-gen HomePod costs £299 and is available to buy now.

which always delivered excellent sound; the problems were more related to its price and the limitations of its smart features.

Oddly enough, anecdotal evidence suggests that Siri, which in theory should be by far the most convenient way to control the HomePod, hasn't improved since the original HomePod was discontinued. Perhaps it is simply more ambitious now, but errors (such as mishearing the name of a band or song, or deciding to guess what to play based on a wild misunderstanding) seem far more common than in previous years. If Apple expects the HomePod to be a success the second time around, we hope it has budgeted for plenty of time to iron out Siri's problems.



6 reasons why the HomePod is Apple's most confusing product in years

There are some real head-scratching facts about Apple's new Siri speaker. **Michael Simon** reports

Last month was a busy one for Apple. As we've already reported, we got new chips, Mac minis and MacBook Pros, and January brought the surprising return of the full-sized HomePod, with a similar design as the original model as well as the same £299 price tag, about two years after it was discontinued.

And when you dig into it, things get even weirder. The new HomePod isn't a carbon copy of the original model, but in subtle and confusing ways that won't be all that noticeable to anyone buying one. Here are six

facts about the new HomePod that have us scratching our heads:

1. APPLE REDESIGNED IT TO LOOK THE SAME

At first glance (and second and third), the 2nd-gen HomePod seems to be identical to the original model. It has the same circular body, mesh exterior, and screen, but there are slight differences. For one, it's 4mm shorter and 200g lighter. The screen at the top is now slightly recessed, and the display is larger and easier to see. The 'seamless mesh fabric' from the original model is now 'acoustically transparent mesh fabric', and stretches a bit more over the top. There's a new Midnight colour that looks a lot like a slightly darker shade of Space Gray. However, none of the changes will make much of a visual difference unless you're comparing a new one and an old one side by side, so it seems strange that Apple went through the trouble of redesigning the HomePod in such small ways.

2. YOU CAN'T CREATE A STEREO PAIR WITH A 1ST-GEN HOMEPOD

One of the HomePod's best features is its ability to create a stereo pair that 'plays each channel in perfect harmony, creating a wider, more immersive soundstage than traditional stereo speakers'. It's not a new feature, but there's a catch: You can't pair a new HomePod with an old one. For a stereo pair to work, you'll need two of the same HomePods: a 1st gen with a 1st gen; mini with a mini; 2nd gen with a 2nd gen. It makes logical sense since the two have different specs, but it sure would have been nice for Apple to figure out a way to make the two play nicely together.

3. IT USES AN APPLE WATCH CHIP INSTEAD OF AN iPHONE ONE

The original HomePod used Apple's A8 processor, which had debuted in the iPhone 6 a few years earlier, as 'the brains behind the advanced audio innovations'. When the HomePod mini arrived a few years later, Apple used an Apple Watch Series 5's S5 chip to 'achieve big sound out of such a compact design'. The 2nd-gen HomePod also uses an Apple Watch chip, the Apple Watch Series 7's S7 processor, 'to offer even more advanced computational audio'. That's all well and good, but it's hard not to think

an A12 or A13 would provide a bit of future-proofing.

4. IT STILL HAS AN INTEGRATED POWER CABLE

One of the original HomePod's biggest shortcomings was the integrated power cable – mainly because people naturally tried to disconnect it and sometimes ended up ruining their speakers. It's possible that Apple changed the connector to stop that from happening, but based on photos, the HomePod still has the same permanently attached power cable on the rear of the device. A switch to a magnetic connector like the 24-inch iMac would have been a nice improvement.

5. IT SUPPORTS SLOWER WI-FI THAN THE IPHONE 6

It's weird enough that the new HomePod still has Bluetooth 5 instead of 5.3 (as found on new Macs and iPhones), but it actually has slower Wi-Fi than the original model. According to the tech specs, the first HomePod supported 802.11ac, better known as Wi-Fi 5 while the newer HomePod uses Wi-Fi 4 (802.11n). Perhaps it's too much to ask for Wi-Fi 6E when the new iPhones don't even support it, but we're surprised to see the new HomePod uses a Wi-Fi standard as old as the iPhone 4.

6. THE AUDIO SPECS APPEAR TO BE INFERIOR

Here's the strangest thing – based on the audio specs, the new HomePod isn't as good as the original model. While it surely 'delivers next-level acoustics' as Apple claims, a quick comparison of the tech specs shows two fewer horn-loaded tweeters (five versus seven) and microphones (four versus six). Of course, all speakers and microphones are not made the same and audio processing counts for a lot. We're confident that Apple will get equal or better audio out of fewer speakers and microphones – but it's strange that Apple didn't actually say the HomePod 2 is better and even stranger that the old HomePod is seemingly superior to the new one on paper.

Review: B&W Px8

Price: £599 from fave.co/3G3Oyxq

I characterized the Bowers & Wilkins Px7 S2 noise-cancelling headphone released last year as "less sizzle, more steak" because its audio performance was phenomenal, but competitors such as the Sony WH-1000XM5 delivered more whiz bang features. With its step-up Px8 noise-cancelling headphone, B&W delivers a great-sounding luxury audio product chock-full of high-tech features.

Luxury comes in the form of the Px8's materials as well as its build quality. Where the Px7 S2 is constructed primarily from plastic, the Px8 features die-cast aluminium arms and diamond-

cut metal detailing. The earcups, memory-foam earcups, and both sides of the headband are wrapped in exquisitely soft Nappa leather.

While those elements add a bit of weight to the headphone – the Px8 weighs 320g compared the Px7's 302g – I found the Px8 to be even more comfortable to wear for long listening sessions than the 350g Focal Bathys. The B&W provides just the right amount of clamping pressure to stay in place, and the earcups provide excellent passive noise isolation even before you bring technology into play (more on that later, of course). The standard-setting – at least in terms of noise-cancellation – Sony WH-1000XM5 tips the scales at just 250g, but sounds relatively inferior to all three of the other models discussed here.

Bowers & Wilkins outfits the Px8 with 40mm carbon-cone drivers, which are angled inside each earcup. B&W says these drivers are lighter and more rigid than the same-sized cellulose drivers in the Px7 S2. The earcups, meanwhile, are removable – and replaceable – should your dog or cat find their scent and/or taste irresistible. More than one headphone has succumbed to that fate in my home.

The ribbed nature of B&W Px8's play/pause button helps your fingers differentiate it from the volume-up and volume-down buttons on either side of it.

FEATURES

The Px8 has a USB-C port for charging, but you can also connect it to a computer to stream high-res audio (24-bit resolution, 44.1- or 48kHz sampling rate). B&W also provides a USB-C-to-3.5mm cable, so you can connect the headphone to an analogue audio source with a 3.5mm headphone jack, such as a high-res digital audio player or pocket DAC.

The fabric-covered, hardshell case Bowers

You'll use the Px8's USB-C port to charge its battery, but it can also connect to digital or analogue audio sources with the included cables. The button on the left-hand earcup can be programmed to either summon your smartphone's digital assistant or switch active noise-cancellation modes.

& Wilkins provides with the Px8 is identical to the one it supplies with its Px7 S2, with one exception: The pull tab on its zipper is a thick slab of leather. There's a storage compartment inside the case for storing your cables, which has a magnetic lid to prevent them from falling out. But if you want an airline adapter, you'll need to provide your own.

The Bluetooth audio is Bluetooth 5.2, with support for aptX HD and aptX Adaptive for Android users, and AAC for iOS users. There is no support for Sony's excellent LDAC Bluetooth codec. The Px8 can be paired with up to two devices at once, such as a smartphone and a computer. It can play audio from only one device at a time, but if you're listening to music on a computer, an incoming call will automatically pause the music whether it's streaming from your phone or from the computer. Phone-call sound quality was excellent at both ends.

B&W's 'wear-detection sensor' is intended to automatically pause music playback when you lift either of its earcups. B&W is clearly looking to compete with Sony's WH-1000XM4 and WH-1000XM5 noise-cancelling headphones with this feature, which also preserves the headphone's battery by putting it into a low-power mode when the headphone is removed.

Unfortunately, the Px8's performance on this score was so erratic as to be pretty much useless.

It would sometimes pause the music when I lifted an earcup, sometimes not; it would sometimes resume the music when I lowered the earcup back against my head, sometimes not.

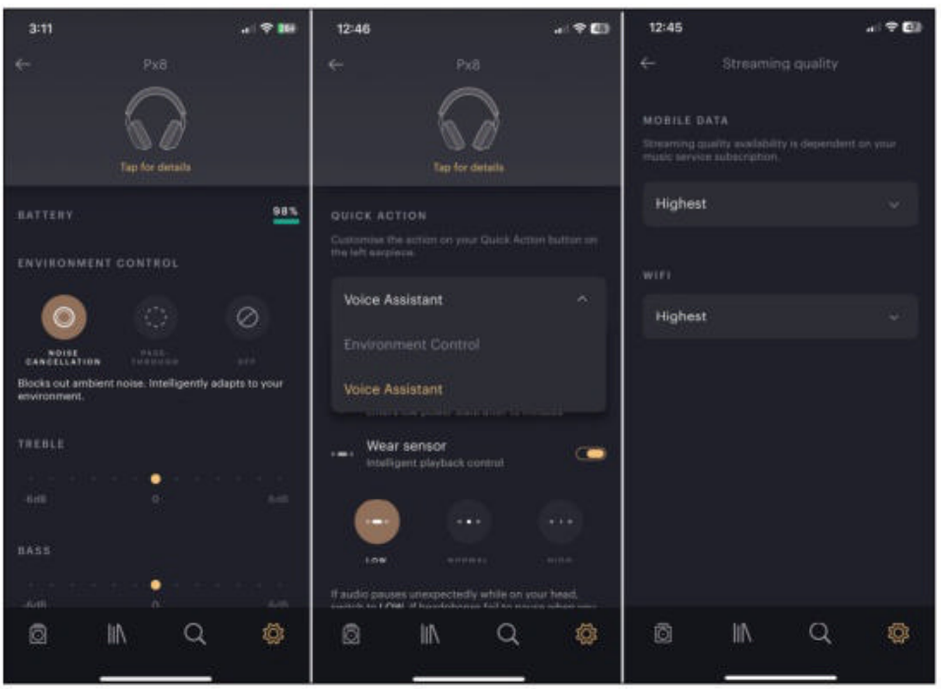
There are three levels of sensitivity for this feature – low, medium, and high – that you set in the B&W Music app, but this didn't help. I eventually disabled the feature altogether, because the headphone would sometimes pause the music even when I hadn't touched an earcup.

Touch control is one feature I'm happy B&W isn't trying to ape. The Px8 has three mechanical controls – fabricated from aluminium – not plastic – on the right-hand earcup: There's a dual-function slider for power on/off and Bluetooth pairing (with support for Google Fast Pairing), a button below that increases the volume, and the last button from the top reduces the volume. A ridged button located between these volume controls toggles between pause and play.

The raised slider makes the three buttons on the right-hand earcup easy to locate by touch, and the ridged play/pause button helps to further orient your fingers. Pressing a 'quick-action' button on the left-hand earcup either summons your smartphone's digital assistant or switches between noise-cancelling modes, which B&W calls 'environmental controls'. You programme this button in the B&W Music app. Unlike the Focal Bathys, you can't use the headphone to summon Alexa.

The B&W Px8's case has a compartment with a magnetic lid for stowing its USB-C-to-USB-C and USB-C-to-3.5mm analogue audio cables.

The app has an EQ slider that lets you boost or cut bass and treble by 6dB. An update to the B&W Music app that came after our review of the B&W Px7 S2 added the ability to stream music from the app to B&W's headphones, with direct connections to



You can now stream to Bowers & Wilkins' wireless headphones directly from its Music app in the same way you can play music on its Wi-Fi speakers.

popular music-streaming services, including Qobuz and Tidal.

NOISE CANCELLATION

Bowers & Wilkins presents no threat to Sony's dominance in terms of active noise cancellation, but the good news is that B&W's ANC doesn't have a detrimental impact on the Px8's audio reproduction, either. The headphone can switch between three modes: noise cancellation on; pass-through, in which the headphone's four microphones pipe ambient sound into the headphone; and noise cancellation off (two separate mics are used for phone calls).

B&W's noise active cancellation is effective enough, masking but not eliminating the kind of low-pitched drone you'll experience on airline flights, but it's less effective at covering up the hiss of fans and HVAC equipment. More importantly for people who care more about audio performance than isolation from the outside world, turning on ANC doesn't mask frequencies you do want to hear.

The Px8 promises 30 hours of battery life and requires about two hours for a full charge. But if you do let the battery run down, a 15-minute charge yields a full seven hours of listening time.

AUDIO QUALITY

The Bowers & Wilkins Px8 is an exciting, natural-sounding headphone with a very wide soundstage. As much as I enjoyed listening to the Px7 S2, the carbon drivers in the

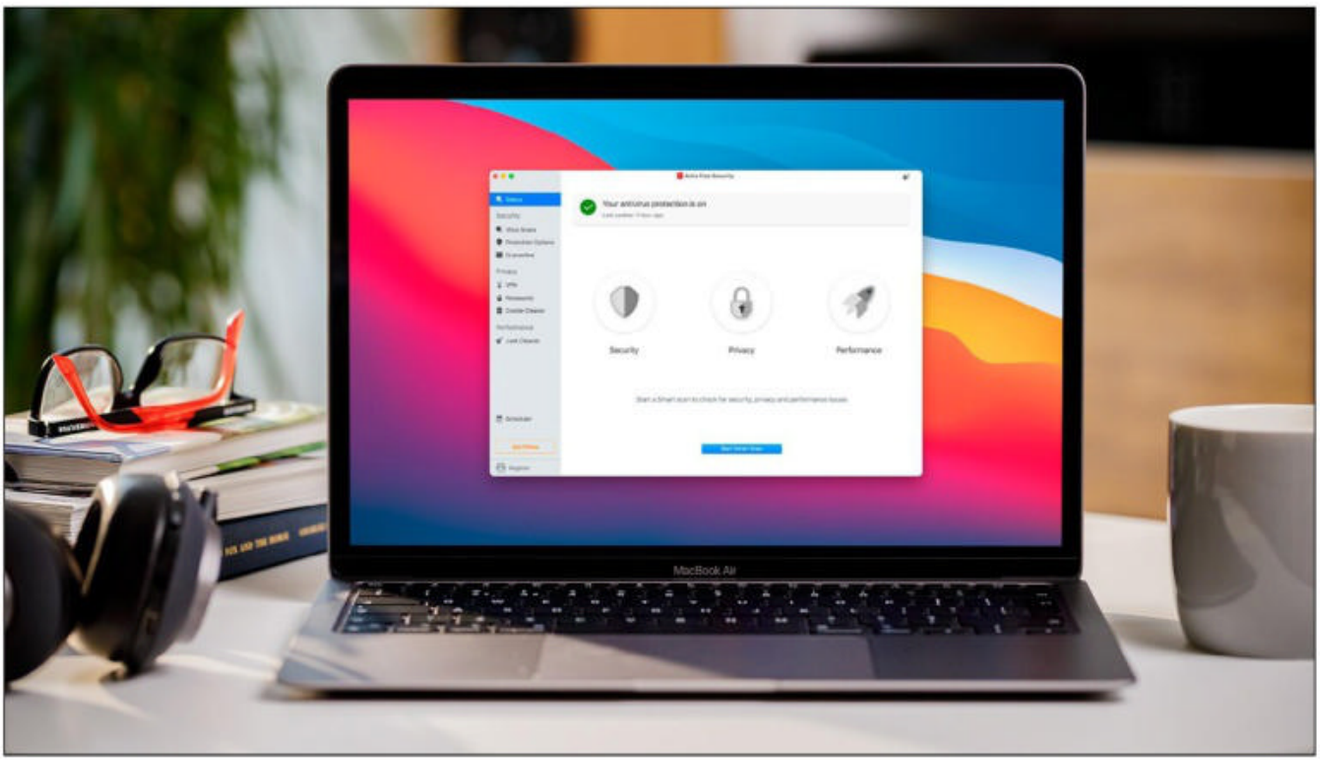
Px8 take things to a whole other level. Listening to Chet Boghassa, from the Tuareg desert blues/rock group Tinariwen's 2004 album Amassakoul (Qobuz streams the remastered high-res version released in 2022), was a mesmerizing experience, with the Px8 reproducing the driving bass and electric guitars without trampling on the intricate vocal harmonies, hand claps, and percussion.

Prominent markings inside the Px8's earcups make it easy to discern right from left.

The 50th-anniversary edition of the Neil Young album Harvest features fantastic renditions of"Heart of Gold and Don't Let It Bring You Down, recorded live in concert at the BBC. You can hear every string resonate on Young's guitar. Listening to tenor saxophonist Pharaoh Sanders' Nophizo, from his 1996 recording Message from Home, showed the Px8 to be as adept with jazz recordings as it is with rock and acoustic folk music, presenting a wide soundstage and revealing every gorgeous detail.

VERDICT

The materials and build quality of Bowers & Wilkins' Px8 headphone surely account for a good chunk of its £599 asking price, but these headphones are much more than a luxury item. They look like £599 headphones, but what's more important is that they sound like £599 headphones. The Px8's carbon drivers are definitely a step up from the cellulose drivers in Bowers & Wilkin's also-excellent Px7 S2. As with other high-end noise-cancelling headphones we've tested, however, Bowers & Wilkins considers the mission of isolating you from the outside world as of secondary importance to high-fidelity audio reproduction. If noise cancellation is your primary criterion for choosing a headphone, stick with Sony or Bose; those manufacturers still do it better than anyone. **Michael Brown**



Avira Free Security for Mac

Price: Free from fave.co/3Hg62XX ★★★☆☆

Some free security programs appear to offer an array of features beyond just basic antivirus protection. But when you dig deep, you find that most of those extra, advanced options actually require a paid subscription. Such is the case with Avira Free Security for Mac. Free for home use, Avira Free Security starts off with antivirus protection but then lists a VPN, password manager, browser cookie cleaner, junk file cleaner, application uninstaller, start-up manager, and PC performance booster. All of these features pop up in the program's dashboard, but only a few are actually accessible in the free product.

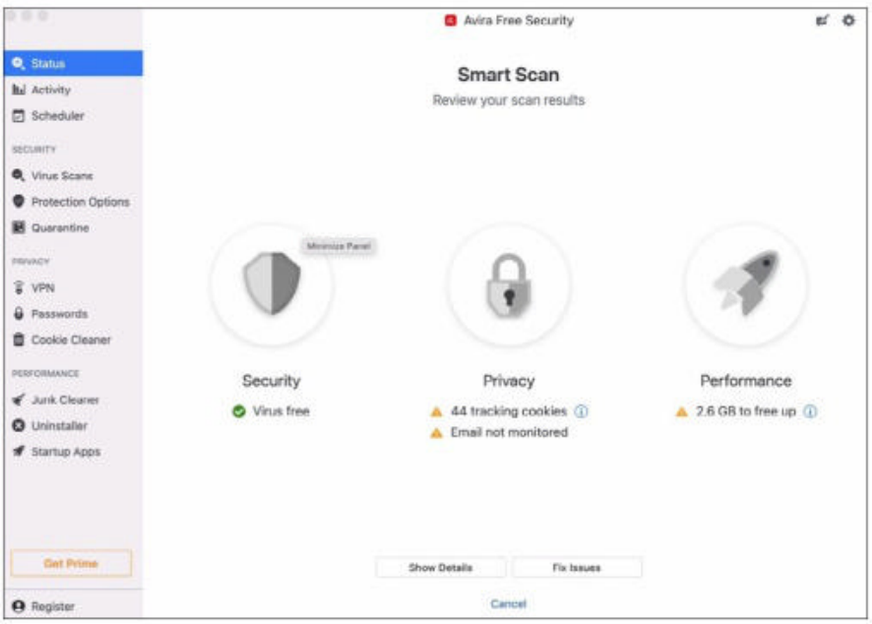
INSTALLATION

The Avira Free Security for Mac installation is quick and painless. The process directs you to the specific preferences on your Mac that must

receive permission for Avira to install. After the initial set-up, the program invites you to run a smart scan on your Mac to check for any security or privacy issues and any performance concerns.

The first time I ran the smart scan on my Mac, Avira caught 44 tracking cookies and informed me that my email was not being monitored for phishing attempts. It also promised that it could free up 2.6GB of disk space. Further details identified one of the privacy issues as tracking cookies in Chrome and the disk space clutter as cache files, logs, and general trash. I could check or uncheck any of these options and then tell Avira to fix the issues.

However, here's where the first sales pitch kicked in. The free version of Avira identified the issues found in the smart scan. But to actually clean up anything beyond the junk files would have required one of the paid editions – Avira Internet Security (£22.99 from fave.co/3wzNrRF) for the first year or Avira Prime (£51.99 from fave.co/3wyhIjY) for the first year.

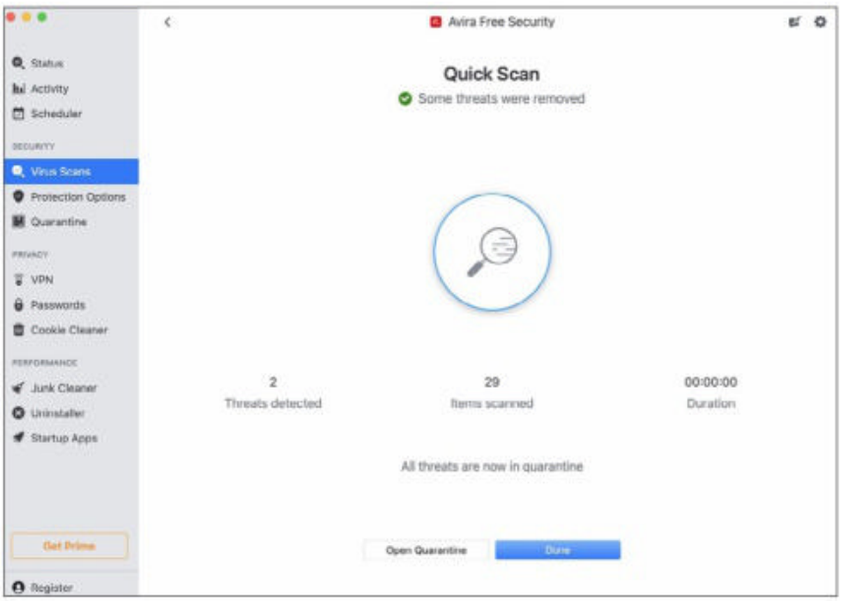


Avira's Smart Scan checks for security, privacy and performance issues. But resolving most of them requires an upgrade to one of the paid editions.

FEATURES

Though the smart scan's usefulness is limited unless you plan to upgrade to one of the paid editions, the program's dashboard seems to offer access to a variety of impressive tools, all organized into three main categories: Security, Privacy, and Performance.

Under Security is the virus scanning. Here, you can run a quick scan to check out system files and other vulnerable areas or a full scan to analyse your entire Mac for malware. With both types of scans, you're

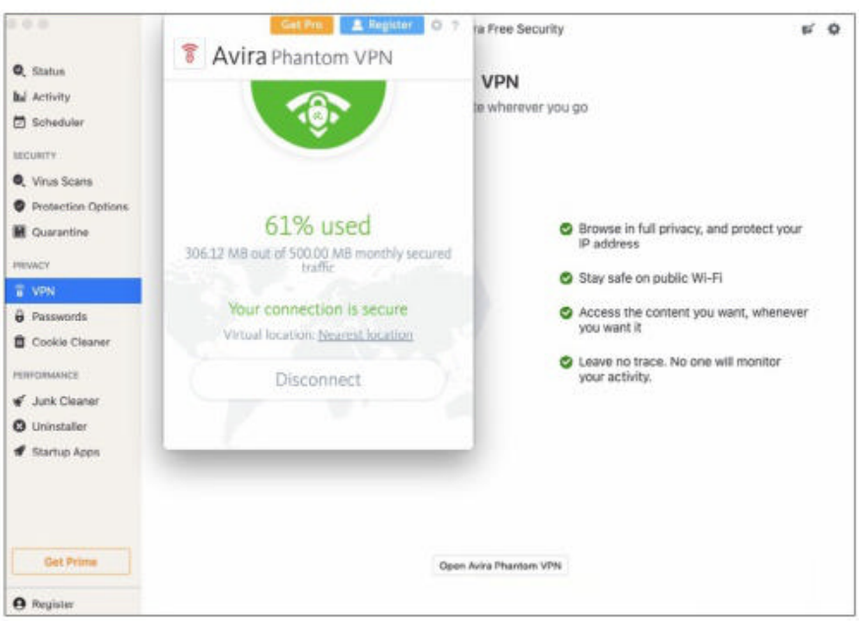


With Avira's antivirus tool, you can run or schedule a quick scan and a full scan and create a custom scan to check specific folders.

able to schedule a scan to run daily, weekly, or monthly. Plus, you can create a custom scan to look only at certain folders.

By default, the real-time virus protection scans any new file saved to your computer as well as files downloaded from the Internet. Scanning USB drives is listed as another option, but that requires one of the paid Avira products. Any malware discovered is automatically quarantined for you to inspect it. Clicking the name of a piece of malware takes you to the Avira website with a helpful analysis of the file.

Under Privacy are the VPN, password manager, and cookie cleaner. To use the VPN, you must download a separate and free tool called Avira Phantom VPN and WiFi Proxy from the Mac App Store. Manually turning on the VPN uses your nearest location for the network. With the free version of Avira, you're limited to just one network location chosen automatically. Plus, your monthly



With the free flavour of Avira, the VPN limits you to one location and up to 500MB of traffic each month.

quota of encrypted traffic tops out at 500MB, which won't last very long.

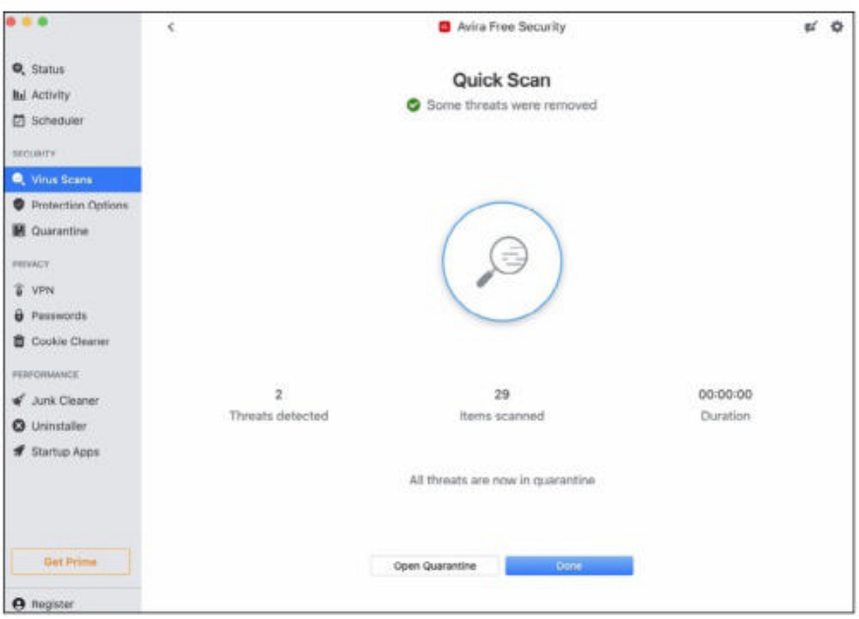
The password manager Avira PWM for Safari works just as a Safari extension. Avira PWM meets the basic functions of a password manager, creating and storing secure passwords, applying them at the associated websites, and requiring you to devise a master password to protect the information. Next on the list is a Cookie Cleaner, but this is yet another feature that requires the paid Prime edition of Avira.

Finally, the Performance category lists three tools – a junk cleaner, an uninstaller, and a start-up app manager. Among these, the junk cleaner is available in the free version of Avira and will scan and remove junk files and other unnecessary files clogging up your system. The uninstaller and start-up app manager both require the Prime edition of Avira.

PERFORMANCE

Avira was effective at detecting and stopping malware. The program easily caught and quarantined the different EICAR test files that I tried to download, including the eicar.com file and the eicar text file. It didn't scan the eicar.zip file when I downloaded it. But when I tried to open the file, Avira caught and quarantined it.

The paid version of the product – Avira Internet Security – received top marks in a September/October evaluation from AV-Test for protection, performance, and usability (fave.co/3WPA1eV). A 2016 review of Avira Free Antivirus by AV-Comparatives (fave.



To improve your Mac's performance, Avira Free Security lists a junk cleaner, application uninstaller and start-up manager, but only the junk cleaner is accessible in the free edition.

co/3XJlMtB) gave the program good grades overall, while a May/June 2022 review of macOS security products awarded high marks to Avira Antivirus Pro (fave.co/3FMzLXW).

VERDICT

The most frustrating part of Avira Free Security is the sheer number of tools that require one of the paid editions. I don't necessarily fault Avira for this type of trickery; it's a game played by a lot of free products. But listing each tool in the program as if it were available felt deceptive to me. Ultimately, the old adage of 'you get what you pay for' is certainly true with Avira Free Security.

Take away the tools that require a subscription, and you're left with the antivirus feature, a limited VPN, a password manager that works only in Safari, and a junk file cleaner. On the surface, that's not a terrible mix for a free product. But you can do better with other free standalone products. **Lance Whitney**

7 macOS Ventura features that will take your new Mac to the next level

Apple's latest version of the Mac operating system has features you'll benefit from immediately. **Roman Loyola** reports

Whether you have a new Mac or just got around to updating your old one, macOS Ventura has a lot of new features to get to know. Regardless of whether you're a veteran or a new Mac user, these new features are ones you'll want to take advantage of. Here are seven of them that your Mac will be better off using.

1. USE YOUR iPHONE AS A WEBCAM

Did you get a new iMac, MacBook Pro, MacBook Air, or Apple Studio Display? Brace yourself, because here's an unfortunate truth about

those machines: the built-in FaceTime camera is a disappointment. But if you have an iPhone 11 or later, you can skip that camera and use a new Ventura feature that lets you use your iPhone as a webcam with Continuity Camera.


1.

While you might know the Continuity Camera feature from previous versions of macOS, in Ventura, Apple has expanded the feature with iPhone webcam support. You can mount an iPhone to your Mac or place it on a stand and Ventura automatically senses the device and wirelessly connects to it. You can then use your iPhone's camera in FaceTime and other apps on your Mac.

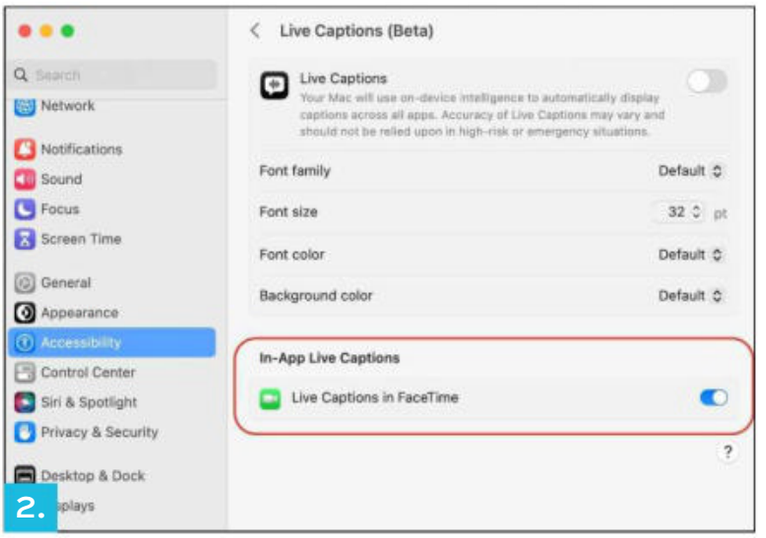
With an iPhone as a webcam, you'll also be able to use Centre Stage to keep you in the centre of the frame, as well as Portrait mode. If you're using an iPhone 12 or later, there's a Studio Light feature that uses the iPhone flash to provide better lighting. And finally, a nifty Desk View feature creates a two-shot view, one of the person, and another of the desktop in front of the Mac, which is handy for demos.

2. SHOW LIVE CAPTIONS IN FACETIME CALLS

If you're having a difficult time hearing the person you're having a FaceTime call with, you can use the Live Captions feature in macOS Ventura. When it's on, the spoken words of the person you're talking to are transcribed in a window on the right side of the FaceTime window.

To activate this feature, go to System Settings > Accessibility > Live Captions (Beta), and then in the 'In-App Live Captions' section switch on Live Captions in FaceTime.

Live Captions also works outside of FaceTime. For example, you can use it while watching a video that doesn't have captions. But as it says in the name, Live Captions is in beta, which means you could run



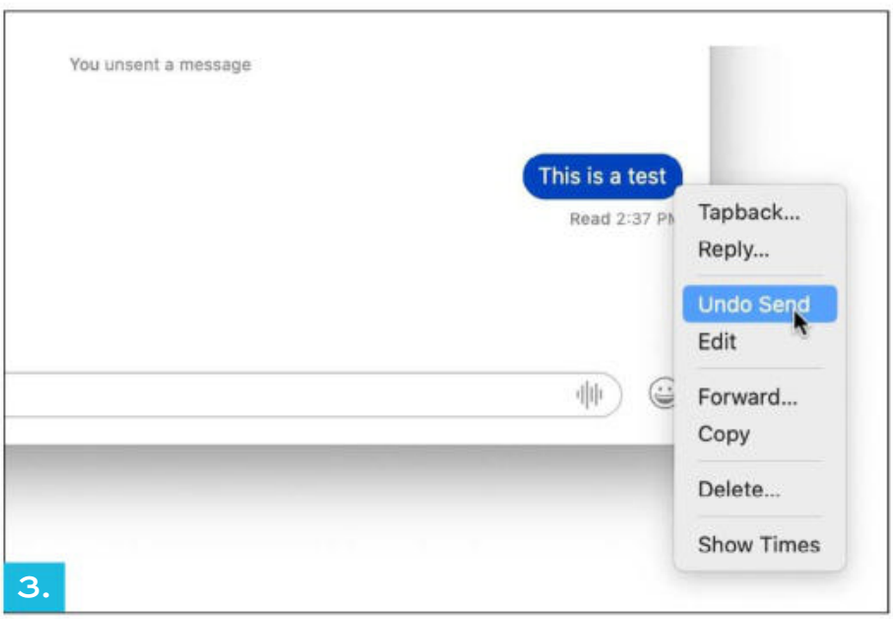
into bugs, inaccurate captions and other quirks.

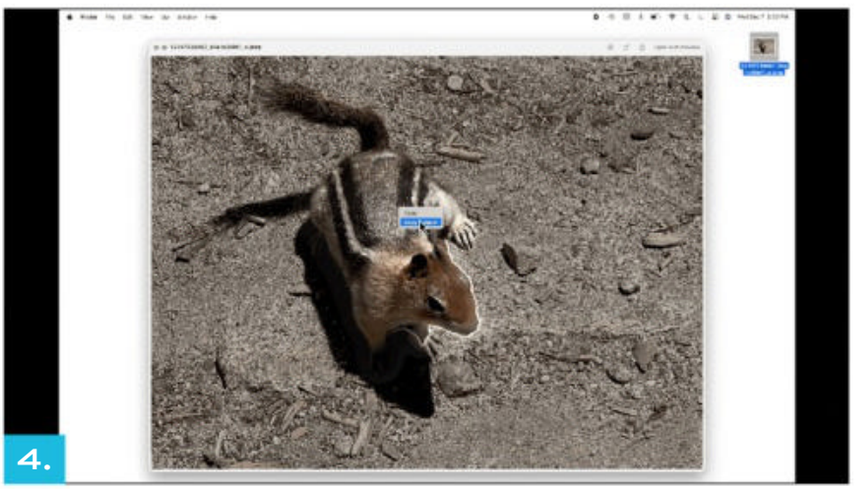
3. UNSEND MESSAGES AND EMAILS

Okay, so you may not need to use this feature right away, but it's happened to all of us – we send an email or text to the wrong person, make a silly typo, or just wish we could immediately take back the note we just sent. Finally, you can unsend messages in macOS Ventura.

In Messages, right-click on the message bubble, and then in the pop-up that appears, select Undo Send. You have two minutes after you send the message to unsend it. Once it's unsent, the message will be deleted but the recipient will see a note saying that the message was deleted. This feature is also available on iOS 16 and iPadOS 16 and only works only when everyone involved is using iMessage. A text message sent from an iPhone to an Android phone or another non-Apple device cannot be unsent.

In Mail, after you send an email, you have 10 seconds to unsend it. At the bottom of the Sidebar, an Undo Send link appears and you can click it to undo the sent email. Get more details on how this feature works. This feature is also available in iOS 16 for iPhone and iPadOS 16 for iPad.





4.

and shows you what will be selected with a glowing outline. Then you actually click the Copy Selection command, and you can then paste it into a new image. This feature is also available in iOS 16 for the iPhone and iPadOS 16 for the iPad.

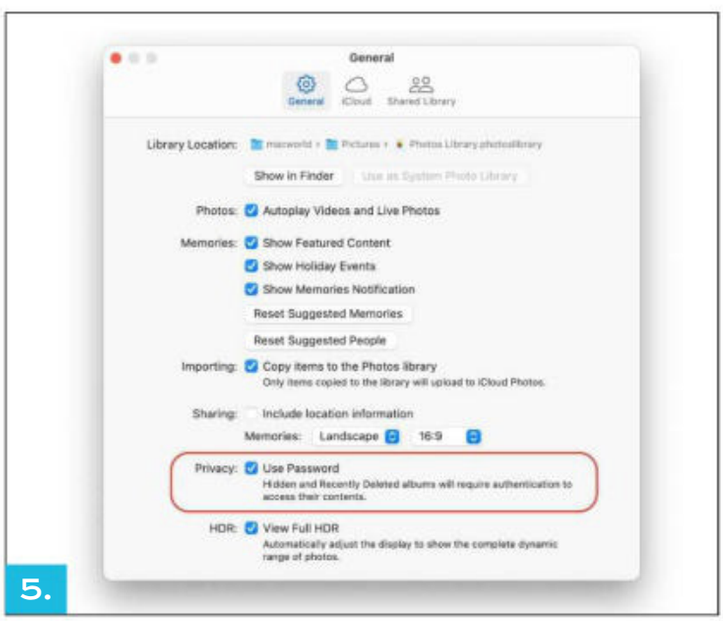
4. QUICKLY LIFT A SUBJECT FROM THE BACKGROUND IN PHOTOS

If you've been spending lots of time in an image editing app to remove the background in a photo, then you'll love how much of a time-saver this feature is. This feature automatically selects the subject that you want, copies it, and then you can paste it anywhere.

This feature is available in both the Preview and Photos apps that come with macOS Ventura, and it also works in Quick Look when you select a file in the Finder and press the spacebar to see a preview. All you have to do is point the cursor over the subject, right-click it, and then mouse over Copy Subject in the pop-up menu. Ventura senses the subject

5. PASSWORD-PROTECT HIDDEN AND RECENTLY DELETED PHOTOS

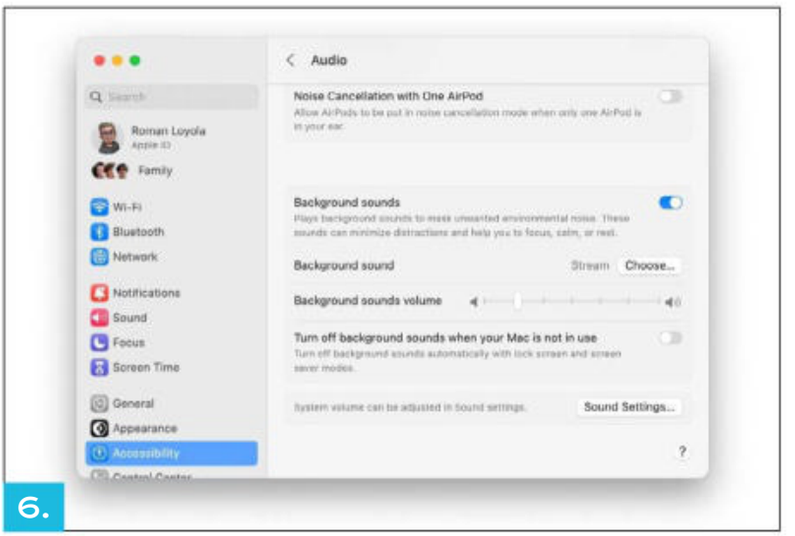
If you use Photos to manage your pictures, the app allows you to hide an image from your feed if you right-click it and then select Hide Photo. It gets placed in a Hidden photo album, but before macOS Ventura, anyone who has access to your Mac account



5.

can open that album.

Finally, in Ventura, the Hidden photo album–as well as the Recently Deleted folder–can be password-protected. To turn this on, go to Photos > Settings > General, and in the Privacy section, check the box for Use Password. Now, when those albums are accessed, you'll need to enter your user password or use Touch ID. Just don't forget it.



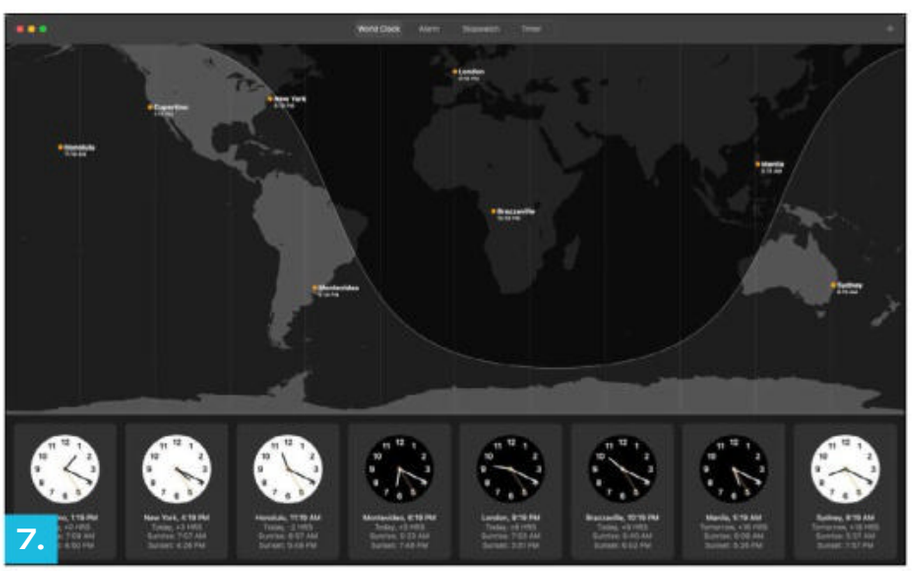
6. PLAY BACKGROUND WHITE NOISE

White noise can help with your concentration, especially if you're in an area with a lot of distractions, or it's dead silent. With macOS Ventura, you can have white noise play from your Mac, and you can turn it on and off as you like.

Go to System Settings > Accessibility > Audio. Scroll down to the Background Sounds section, and you can flip the switch to turn it on. You can also choose the type of sound you want to play and adjust the volume. After it's all set up, you can turn it on and off in the Control Centre. Learn more about this feature.

7. KILL TIME WITH THE CLOCK APP

The Clock app that is on iOS and iPadOS is finally on the Mac. It



works just like it does on the iPhone and iPad, so it's all very familiar. You can set timers and alarms, and track different times all over the world in a beautiful interface that lets you see time zones in locations all over the world. And it also works with Siri on the Mac, so you can use voice commands instead of opening the app.

Help Desk

Solutions to all your Mac problems. **Glenn Fleishman** reports

HOW TO MOVE A CHILD'S APPLE ID ACCOUNT TO THEIR OWNERSHIP WHEN THEY BECOME ADULTS

As hard as it is for me to believe, my older child recently turned 18. The age of majority in the UK means that they are now able to take charge of – and are personally responsible for – a lot more of their life that my spouse and I managed for them. This includes online accounts that we set up for them at places like government agencies (for passports and ID), Amazon, and the like.

With two-factor authentication (2FA) encouraged or required at many sites, what's the easiest way to pass control from you to your child while keeping security intact? Here's

a general set of steps that relies on Apple operating systems and iCloud Keychain. First, log into the account. Next, copy the account information to your child:

Stored Passwords: With passwords stored in your keychain on an iPhone, iPad, or Mac (or synced via iCloud Keychain), you can share the entry with your child. This varies by operating system version and version. In iOS 15/iPad 15, go to Settings > Passwords, find the entry, and tap the share button; in macOS 12 Monterey, either go to System Preferences > Passwords or Safari > Preferences > Passwords, find the entry and click the share button. Use AirDrop or another method to send it to your child.

Third-party password managers: With 1Password or other password managers and with a shared vault enabled, you can copy or move the entry to that shared vault. You may also be able to share an entry from the app that can be opened with a free or paid version of the app your child has installed. (Warning! I highly recommend against using Google Chrome's password manager, as it lacks device-locked end-to-end security provided by iCloud Keychain and major third-party password managers.)

Read passwords aloud: You can also literally read the password aloud and have your descendant repeat it back to you for accuracy. (Just like the old days: reading aloud to your child.)

Have your child create an account in their password management app – including Passwords in iOS, iPadOS or macOS – before proceeding so they can add a verification code in an upcoming step. But don't have them log in yet.

Update associated data in the account:

Email: If you've been using an email address under your control to manage their account, it's time to migrate that. Change the email address. You may need to change both an account login address and an email address used for sending messages (some sites manage those separately). Wait until you've handed over all account credentials before they click a link to confirm via email to avoid losing access while you're still transitioning the account.

Phone number: Change the phone number to theirs. They may receive a confirmation call or text that they can read out to you or show you, and you can confirm for them immediately.

Mailing address: Update the mailing address if they've moved or are just about to.

Finally, shift second-factor authentication over on accounts that require it. If you're at a site that allows multiple 2FA authenticators that can produce a TOTP (time-based one-time password) used for verification, you can add their authenticator as the next step.

1. Choose to add an authenticator.
2. Name it descriptively if given an option (you usually are).
3. The site displays a QR code and usually the corresponding "seed" text (a shared secret) for the token. Your child can use an authentication app (I recommend Authy), a third-party password manager with TOTP support like 1Password, or Apple's built-in TOTP recognition system. If they have an iPhone or iPad, an authentication or password app will bring up a camera view, or use the Camera app for to add to an Apple-managed login.

Set up a new authenticator or disable and re-enable two-factor authentication to pass along proper security to your youth.

If they don't, you can read aloud the seed code, and they can enter it in the appropriate place. (See below for more about Apple's approach.)
4. The authentication app or component generates a code on your child's device that you then enter to confirm accurate enrollment.
5. Delete your authenticator and log out.

For sites that don't allow more than one authenticator, disable 2FA, log out, and have your child log in with the account and password (first confirming a new email address if necessary via an email link), and then help them enroll in 2FA if they aren't familiar with it.

Apple supports TOTPs – it calls them "verification codes" directly within iOS 15, iPadOS 15, and macOS 12 Monterey and later. In iOS 15/iPadOS 15, you can use the Camera app to point at a QR code, and then tap an onscreen link to add the verification code. You can also touch and hold a code on a web page or in email and select Add Verification Code. In Monterey, you can Control-click or right-click a QR code on a web page to add it. However, you can only add a verification code to an existing account, so be sure your child created the account entry early in the process, as noted above.

Your child can now delete all remaining traces of you from their account or continue to have you in there as a 'rescue email' or 'trusted phone number' or the like if they want to have a backup for restoring account access in addition to options provided by the service

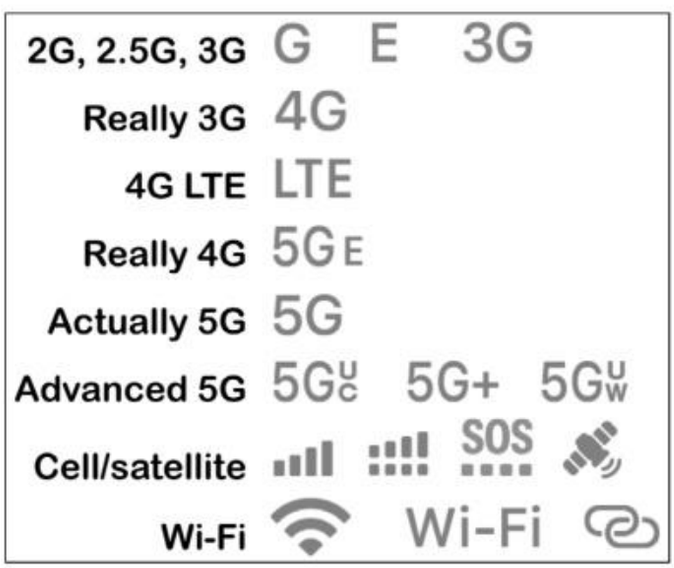
WHAT THE CELLULAR, WI-FI AND SATELLITE SYMBOLS MEAN ON YOUR iPHONE OR iPAD

The upper-left and sometimes upper-right corner of your iPhone or iPad display does a lot of work packing in meanings using symbolic shorthand. Apple has used since the iPhone's introduction a few letters or a tiny graphic to let you know at a glance the performance, nature, and quality of your Internet signal.

But with so many generations of cellular technology in use and so many symbols involved, can you decipher them all? Here's your guide to understanding the oldest to newest symbols. (See image below.)

Cellular generations started with an analogue service, now called 1G. The first digital service, 2G is our starting point:

G, E, 3G: These symbols represent 2G, 2.5G (EDGE), and 3G. EDGE was a bridge technology that aggregated 2G cellular channels for greater throughput, used by Apple in iPhones



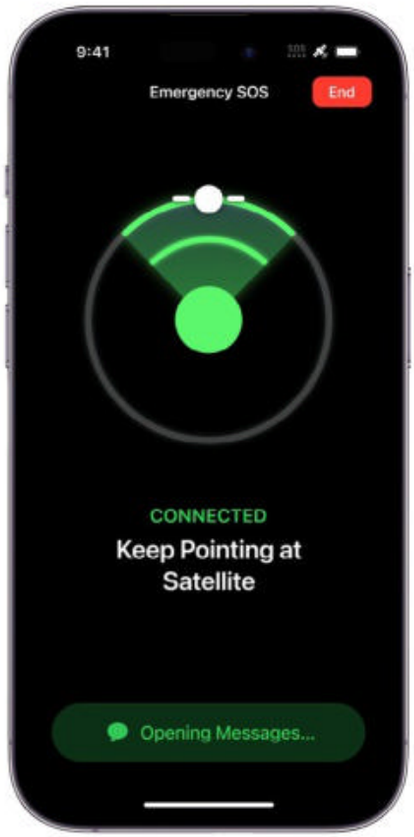
Cellular and Wi-Fi icons.

before the company felt 3G chipsets were low energy enough to deploy without draining batteries quickly. 2G, 2.5G, and 3G networks have either shut down or have deadlines to shut down in most countries that have deployed 4G and 5G networks. These early flavours used frequency ranges inefficiently, and carriers want to use them now to carry much more data.

4G: Really a faster version of 3G, it was more of a marketing label – about 6Mb/s downstream and less than 2Mb/s upstream. You may still see this on some networks and phone models. It's more likely you'll see, however…

LTE or 5GE: Both technologies use 4G protocol – the '5G' in '5GE' is pure marketing – which offers up to tens of megabytes per second downstream and several Mb/s upstream. They were evolutionary steps on the road to true…

5G: The 5G icon appears when connected to a 5G network that roughly overlaps frequencies previously used for LTE. T-Mobile uses it to indicate its 'extended range' network, as their 5G upgrade allows a greater high-speed coverage area than LTE cellular transmitters in the same locations. Data rates are somewhat speedier than LTE, but not lightning fast.



If you have an iPhone 14 in a country that supports it, a satellite icon appears when you engage Emergency SOS via satellite.

5G or 5GUC: Depending on your carrier and region, you might see either 5G or 5GUC for connections that can run from 100- to 300Mb/s downstream.

5GUW: In the United States only (for now), another version of 5G uses a high frequency or millimetre wave band that can offer up to 1Gb/s, and some carriers call this 'ultrawideband'. For that flavour Apple confusingly shows 5G+; for others, 5GUW.

Cell/satellite: The icon at far left is familiar from decades of its appearance. The number of bars indicates signal strength. If you have either a SIM and eSIM or two eSIMS active, the second-from-left icon shows signal strength for the primary network on top and secondary on the bottom. The dot below the bar indicates the secondary network's signal strength. With iOS 16/iPadOS 16, Apple enhanced a 'No Service' label when there's no signal to read 'SOS' with dots beneath it when another cellular network may be available for emergency calls. If you have an iPhone 14 in a country that supports it, the icon at far right that shows a satellite appears when you engage Emergency SOS via satellite.

Wi-Fi: The familiar Wi-Fi waves show a weak, moderate, or strong connection (left). The centre icon oddly has nothing to do with Wi-Fi performance: it appears when you have Wi-Fi Calling enabled and you're connected to a Wi-Fi network that allows it to work. The icon at right, two overlapping chains, indicates the iPhone is connected to the Internet via tethering. (This includes Wi-Fi for a Personal Hotspot, Bluetooth and USB.)

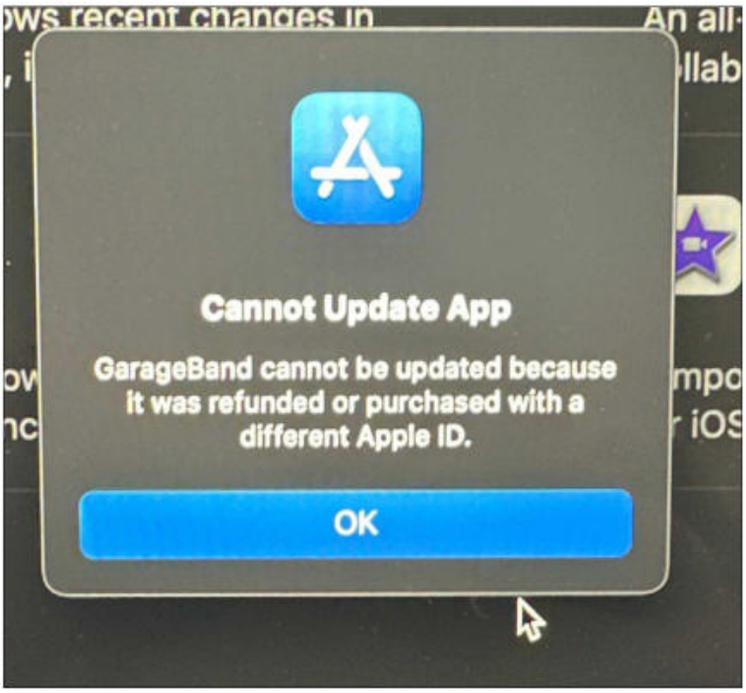
HOW TO FIX A MACOS APP STORE 'CANNOT UPDATE APP' ERROR

If you see an error like 'GarageBand cannot be updated because it was refunded or purchased with a different Apple ID', it may surprise you. Isn't GarageBand free? Isn't your Apple ID the one in use on your Mac? Apple cryptographically encodes into every app downloaded the Apple ID of the purchaser. That's true with 'free' apps (truly free or free with in-app purchases) and paid ones alike, including Apple's own software, such as Pages and GarageBand.

You can wind up with the above error in a few cases: you purchased a Mac with software already installed and try to update it, or you changed the Apple ID used for purchases on your Mac. Other more obscure conditions may apply, but they're not documented. (If you didn't purchase an app that's installed on a Mac you bought or were given, there's no way to receive updates without the original Apple ID login.)

The solution is quite easy:

1. Find the applications in your Applications folder.
2. Drag it to the Trash, or select it and press Command-Delete.



A Macworld reader was unable to update their copy of GarageBand.

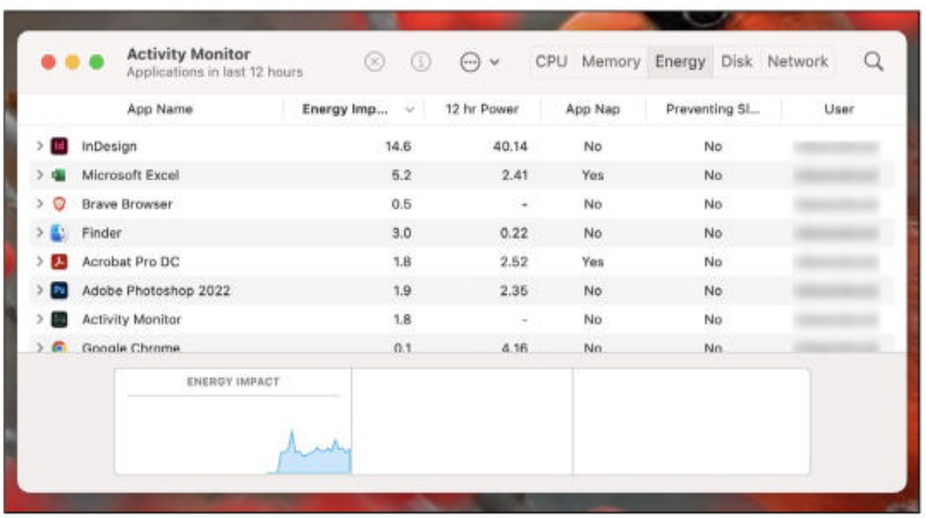
3. Enter an administrator password when prompted.
4. Empty the Trash.
5. Go to the App Store and attempt to download the app again. This time it should work.

In the event that you still have an error, now also try:

In the App Store, choose Store > Sign Out and then Store > Sign In. Restart your Mac.

HOW TO CHECK YOUR MAC'S INTERNAL TEMPERATURE AND KEEP IT COOL

Waves of extreme heat have already passed across the UK, Europe and other parts of the world last summer. While people are at the greatest risk from high temperatures, your Mac may be even more fragile. (People can be water cooled and no current Mac offers that option – though some have tried, fave.co/3QsrgWC.) An iPhone or iPad will warn you when it detects it's too hot before shutting down, while a Mac may simply suddenly power off. If it doesn't power down, you may be running it to close to its maximum capability and



You can use the Activity Monitor app to look at Energy Impact in the Energy column for more particulars.

putting a lot of additional wear in the process on components that might fail later during other seasons.

Knowing the temperature is one thing. The other is how hot should your internal components run? Apple says (fave.co/3ZqztyL) you should only use a Mac when the ambient temperature – the temperature around you – is in the range of 10° to 35°C and 95 percent or lower humidity.

Internal components produce far more heat than the ambient temperature, with around 40°C often the minimum at which they operate in normal indoor circumstances. CPUs, GPUs, ports, and other elements shouldn't exceed about 89°C for extended periods. At 100°C, the boiling temperature for water at sea level, you should either figure out what energy hogs are making your computer work that hard or shut the system down for a while. (Hint: It's almost always a browser.) You can use the Activity Monitor app in Applications > Utilities to look at Energy Impact in the Energy column for more particulars.

Checking the Mac's temperature

Moderns Macs have an inordinate number of power sensors to detect problems and manage fan speeds in models that contain them – I count 34 using one tool on an M1 Mac mini. These sensors can be monitored with the right knowledge or software.

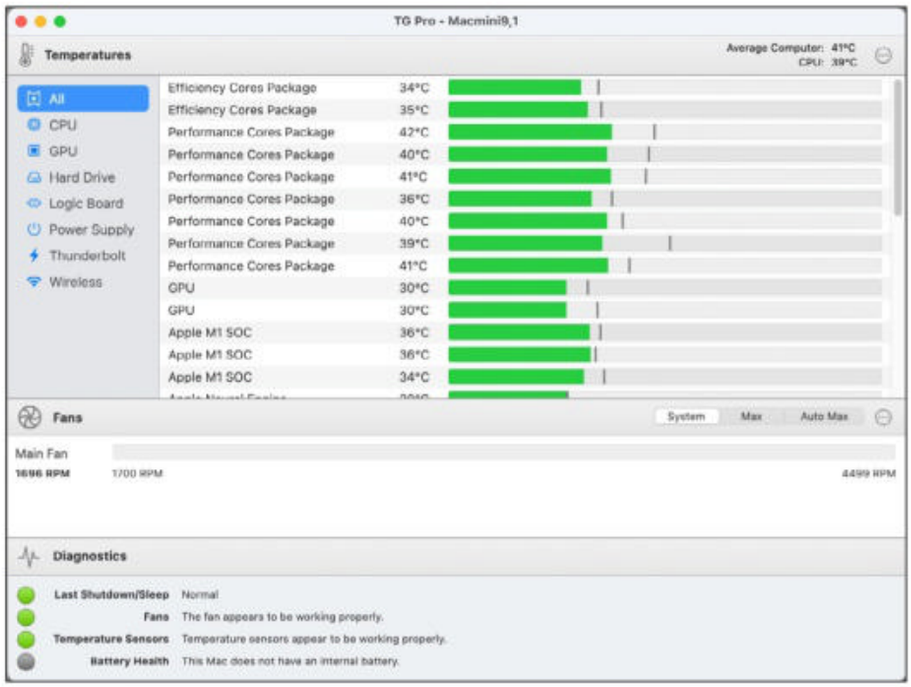
On some Intel Macs, you can use Terminal or a free utility for basic temperature monitoring. In Terminal enter the following command and press return:

```
sudo powermetrics --samplers smc |grep -i "CPU die temperature"
```

(Note that those quotation marks are straight double-quotes.) Enter your administrative password when prompted. This will provide a continuous temperature reading of the CPU's temperature. Press Control-C to stop the monitoring.

You can also install the free app Fanny (fave.co/3ZtIU0C), which offers a simple drop-down set of information in the menu bar or as a notifications widget. Details include the average CPU and GPU temperature along with current fan speeds.

For any Intel Mac and M1-based Mac, the utility TG Pro, (£9.60 from fave.co/3PRzNAF) provides detailed monitoring and fan control.



TG Pro provides an enormous amount of detail on demand and control of built-in fans, but uses colour coding and a menu bar summary for at-a-glance status.

You can see the temperature recorded by every sensor in your Mac and for hard disks and SSDs that support the industry-standard SMART diagnostics. Information and controls are available both in a standard app window and a drop-down menu bar. That bar shows the highest port and CPU temperature and the current fan rotation.

You can also monitor the speed of internal fans and override Apple's settings. This includes creating rules for when fans and how fast fans run. The app comes with a preset rule that turns the blades up to their maximum rotation if the highest temperature of any CPU parameter is at least 70°C. Just note, your MacBook Air doesn't have a fan.

INSIDE: WHY 2023 IS SET TO BE APPLE'S BIGGEST EVER

Macworld

FEBRUARY 2023

BOOST YOUR MAC'S PERFORMANCE

SPEED UP YOUR MAC WITH A CLEANING APP

an IDG, Inc. company