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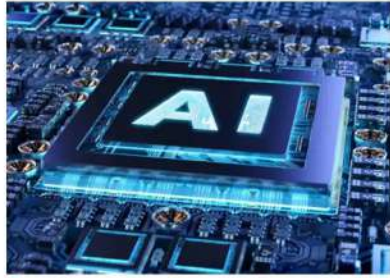and your loved one at **AARP.org**/caregiving

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'AI PCs' are everywhere at CES 2024. What does it mean for you?

There is a there there. **BY BRAD CHACOS**

To the surprise of exactly nobody who has been following the PC industry the last six months, "AI PCs" were everywhere at CES 2024, powered by new chips like Intel's Core Ultra (fave.co/3Hk1rV5) and AMD's Ryzen 8000 (fave.co/3O2qT5c) with dedicated "Neural Processor Units" (NPUs). These help accelerate AI tasks locally, rather than reaching out to cloud servers (as ChatGPT and Microsoft Copilot do). But what does that actually mean for you, an everyday computer user?

That's the question I hoped to answer as I wandered the show floor, visiting PC makers of all shapes and sizes. Most early implementations of local, NPU-processed software have focused heavily on creator workloads—improving performance in tools like Adobe Photoshop, DaVinci Resolve, and Audacity (fave.co/3SjvpPu). How can local AI help the average user?

IMAGE: KANAWATTH/SHUTTERSTOCK

After scouring the show, I can say that NPU improvements aren't especially compelling yet in these early days—though if you have an Nvidia *GPU*, you've already got powerful, practical AI at your fingertips.

But first, let's talk about NPU-based AI.

LOCAL AI TAKES BABY STEPS

Frankly, NPU-driven AI isn't compelling yet, though it can pull off some cool parlor tricks.

HP's new Omen Transcend 14 (fave.co/3tLwvKq) showed off how the NPU could be used to offload video-streaming tasks while the GPU ran *Cyberpunk 2077*—nifty, to be sure, but once again focused on creators. Acer's Swift laptops (fave.co/48V1ouy) thankfully take a more practical angle. They integrate Temporal Noise Reduction and what Acer calls PurifiedView and PurifiedVoice 2.0 for AI-filtered audio and video, with a three-mic array, and there are more AI capabilities promised to come later this year.

MSI's stab at local AI also tackles cleaning up Zoom and Teams calls. A Core Ultra laptop demo showed Windows Studio Effects tapping the NPU to automatically blur the background of a video call. Next to it, a laptop set up with Nvidia's awesome AI-powered Broadcast software was doing the same. The Core Ultra laptop used dramatically less power than the Nvidia notebook, since it didn't need to fire up a discrete GPU to process the background blur, shunting the task to the low-power NPU

instead. So that's cool—and unlike RTX Broadcast, it doesn't require you to have a GeForce graphics card installed.

Just as practically, MSI's new AI engine intelligently detects what you're doing on your laptop and dynamically changes the battery profile, fan curves, and display settings as needed for the task. Play a game and everything gets cranked; start slinging Word docs and everything ramps down. It's cool, but existing laptops already do this to some degree.

MSI also showed off a nifty AI Artist app, running on the popular Stable Diffusion local generative AI art framework, that lets you create images from text prompts, create suitable text prompts from images you plug in, and create new images from images you select. Windows Copilot and other generative art services can already do this, of course, but AI Artist performs the task locally and is more versatile than simply slapping words into a box to see what pictures it can create.

Lenovo's vision for NPU-driven AI seemed the most compelling. Dubbed "AI Now," this text input-based suite of features seems genuinely useful. Yes, you can use it to generate images, natch—but you can also ask it to automatically set those images as your wallpaper.

More helpfully, typing prompts like "My PC config" instantly brings up hardware information about your PC, removing the

HP's new Omen Transcend 14 showed off how the NPU could offload video-streaming tasks while the GPU ran Cyberpunk 2077.

documents, spreadsheets, and so on. Now *this* seems truly useful, mimicking cloud AI-based Office Copilot features that Microsoft charges businesses an arm for a leg for.

However, AI Now is currently in the experimental stage, and when it launches later this year, it will come to China first. What's more, the demo I saw wasn't actually running on the NPU yet—instead, Lenovo was using the traditional CPU heavyweight for the tasks. Sigh.

And that's my core takeaway from the show. NPUs are only just starting to appear in computers, and the software that taps into them ranges from gimmicky to "way too early." It'll take time for the so-called "AI PC" to develop in any practical sense—unless you already have an Nvidia graphics card installed, that is.

need to dive into arcane Windows submenus. Asking for "eye care mode" enables the system's low-light filter. Asking it to optimize battery life adjusts the power profile depending on your usage, similar to MSI's AI engine.

Those are useful features, albeit somewhat niche, but the feature that impressed me most was Lenovo's Knowledge Base. You can train AI Now to sift through documents and files stored in a local Knowledge Base folder, and quickly generate reports, synopses, and summaries based on only the files within, never touching the cloud. If you stash all your work files in it, you could, for instance, ask for a recap of all progress on a given project over the past month, and it will quickly generate that using the information stored in your

THE AI PC IS ALREADY HERE WITH GEFORCE

Visiting Nvidia's suite after spending time with the laptop makers drove home that the AI PC is, in fact, already here if you're a GeForce owner.

That shouldn't come as a surprise. Nvidia is at the forefront of AI development and has

been driving the segment for *years*. Features like DLSS, RTX Video Super Resolution, and Nvidia Broadcast are all tangible, practical real-world AI applications that users love and use every day. There's a reason Nvidia can charge a premium for its graphics cards.

The company was showing off some cool cloud-based AI tools—its ACE character engine for game NPCs (fave.co/48V463e) can now hold full-blown generative chats about *anything*, in a variety of languages, and its iconic Jinn character did not appreciate it when I told him his ramen sucked—but I want to focus on the local AI tools, since that's the point of this article.

Nvidia is at the forefront of AI development and has been driving the segment for years.

A lineup of creator-focused Nvidia Studio laptops were on hand to show just how powerful GeForce's dedicated ray-tracing and AI tensor cores can be at accelerating creation tasks, such as real-time image rendering or removing items from photos. But again, while that's amazing for creators, it's of little practical benefit to everyday consumers.

Two other AI demos are.

One, a supplement to the existing RTX Video Super Resolution (fave.co/3lpiRZe) feature that uses GeForce's AI tensor cores to upscale and beautify low-resolution videos, focuses on using AI to translate standard dynamic range video into high dynamic range (HDR). Dubbed RTX Video HDR, it looked

truly transformative in demos I witnessed. The overly crushed darks in a *Game of Thrones* scene caused by video compression were cleared up and brightened using the feature, delivering a stunning increase in image quality. It was a similar story in an underground scene from another still, where the back of a subway was dark beyond comprehension, but RTX Video HDR let you pick out a tunnel, garbage cans, and other hidden aspects previously lost to the gloom. It looks *great* and should be arriving in a GeForce driver later this month.

Then there was Chat with RTX, which truly impressed me. Most AI chatbots bump your requests out to the cloud, where they're processed on company servers and then sent back to you. That's not the case Chat with RTX, an upcoming application that runs on

either the Mistral or Llama LLMs. The key thing here is that it can also be trained on your local text, PDF, doc, and XML files, so you can ask the application questions about your specific information and needs—and it all runs locally. You can ask it questions like, "Where did Sarah say I should go to dinner next time I'm in Vegas?" and have the answer pop right up from your files.

Better yet, since it runs locally, the answers in our demos appeared much faster than the answers generated by cloud-based LLMs like ChatGPT, and you can also point Chat with RTX to specific YouTube videos to ask questions about their content or receive a general summary. Chat with RTX scans the YouTube-provided transcript for that particular video, and your answer appears in seconds. It is *rad*.

Chat with RTX should also be out in demo form too, and Nvidia is releasing its backbones so that developers can create new programs that tap into it.

Compared to the AI demos I saw for NPU applications, the features on display at Nvidia's booth felt both more practical and much more powerful. Nvidia reps told me that was a goal for the company: to show that AI PCs already exist and can drive genuinely useful experiences—if you have a GeForce GPU, of course.

BOTTOM LINE

And that's really my overarching takeaway on the AI PC from CES 2024. Will AI amount to more than former buzzwords like "blockchain" and "the metaverse," which fizzled out in spectacular fashion? I think so. Companies like Nvidia are already using it to amazing effect. But NPUs are practically still in diapers and learning to talk. There's no overly compelling practical feature that taps into them yet unless you're a content creator.

Don't get me wrong: The future looks potentially bright for local NPUs as a whole—the entire computing industry is willing it into being before our very eyes (fave.co/3FQsSVF)—but if you want a true AI PC *right now*, one with tangible, practical benefits for everyday computer users, you're better off investing in a tried-and-true Nvidia RTX GPU than a chip with a newfangled NPU. ⏻

Chat with RTX was able to provide an accurate description of Nvidia's new ACE features after being pointed to a local file.

Best of CES 2024: The PC hardware that wowed us

There was so much more than hype about AI. **BY KATHERINE STEVENSON**

Of course, we knew that AI would figure prominently at this year's CES. It's the technology story *du jour,* after all. But as CES veterans, we've seen such sparkling promises of the *next big thing* eventually fizzle. 3D televisions, anyone? Thankfully there was plenty of meat-and-potatoes PC tech on display in Las Vegas to satisfy the cravings of PC enthusiasts here and now.

Whether you're a road warrior, a PC builder, a lover of games both old and new, or a content creator, we saw some truly exciting products for PC users of every stripe, and yes, some of it even includes AI.

1. MSI MEG 321URX QD-OLED MONITOR

MSI could've left well enough alone with the MEG 321URX QD-OLED monitor (fave.co/3SiuApZ). I mean, it's impressive as hell just off pure specs alone: This 32-inch, 4K, 240Hz OLED monitor with DisplayHDR True Black 400 certification and 99 percent coverage of the DCI-P3 color spectrum is already better than everyone owns except the 0.01 percent of PC enthusiasts, in a form factor those enthusiasts have been begging for. Gimme!

But MSI didn't stop there. The company also infused the monitor with several AI capabilities, the most intriguing of which is AI Skylight. In the ultra-popular *League of Legends*, AI Skylight keeps tabs on where your enemies are elsewhere on the battlefield, cluing you in to incoming hostiles via large red skulls with directional indicators so you're never caught flat-footed. MSI's also working on training the AI feature in other esports games like *Dota 2*, while a separate AI-powered lightbar across the bottom of the display provides quick visual indicators of things like your health in *League* and your ammo count in *Counter-Strike* (better make those last few shots count).

Better yet (kinda): Since the MEG 321URX does all its processing within the monitor itself, it skirts existing cheat detection software so you won't catch a ban for using the tools.—*Brad Chacos*

2. AMD RYZEN 8500G

Six cores, 12 threads, 5.0GHz turbo clock speeds, no AI: $179. Why would we award a Best of CES award to a chip that lacks Ryzen AI, when AMD is the first to release an AI NPU on a desktop processor (fave.co/3O2qT5c)?
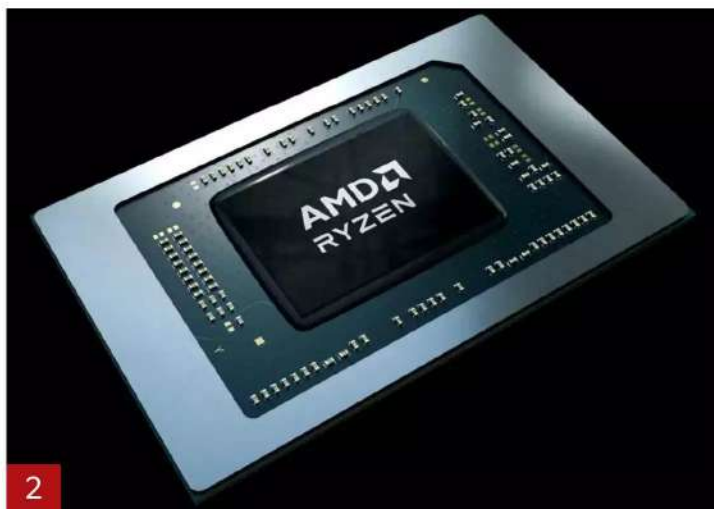
Color me a bit skeptical about AI right now, when its value hasn't yet been proven. And the $229 that AMD is charging for the nearly identical 8600G is $50 more than the 8500G, which at $179 just feels like a solid value. As for Intel, its 14th-gen Raptor Lake Refresh parts (fave.co/4baASzB) just feel a little too similar to the 13th-gen parts right now, lacking a solid gen-over-gen improvement. Maybe further testing will change our minds.—*Mark Hachman*

3. MSI CLAW

The battle among handheld gaming PCs rages on, and at CES 2024, an exciting new entrant appeared: MSI's Claw. Not only is this MSI's first jump into the handheld arena, it also marks the first handheld to feature Intel's Core Ultra processor with Arc graphics, which looks to take on AMD's dominance in the space. In my limited time on the show floor with the Claw, I was impressed by the build quality and design, and the software seems to be coming along nicely as well. Performance

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and battery life are still be determined, which can make or break a device, but I believe we now have a viable competitor to the Steam Deck and ROG Ally.—*Adam Patrick Murray*

MSI's Claw portable gaming PC is my pick for CES—not for what it is (because frankly, its chipset is the only interesting thing about it), but for what it represents. The Steam Deck seemed like an experiment two years ago, and being quickly copied by smaller indies that relied upon crowdfunding didn't change that. But now huge players like Lenovo, Asus, and MSI want a piece of the pie, and can compete at prices below $1,000. It's clear that the portable gaming PC is a form factor with some staying power.—*Michael Crider*

4. LENOVO'S PREPPER-FRIENDLY WIRELESS MOUSE AND KEYBOARD

The most unusual concept I've ever seen has to be Lenovo's hand-cranked mouse and spinning dial wireless keyboard (fave. co/48yCNMw). The 12,800 DPI wireless mouse has a pull-out crank that, if you physically spin it around enough times, will generate 30 minutes of power. The wireless keyboard works in a similar fashion, but instead of a pull-out crank, you just spin the Surface Dial-like knob on the upper-left corner of the deck. Spin this bad boy for five

choking hazard) a giant heap of LEGO blocks.

Thankfully, Asus has fixed my problem by announcing the ROG NUC mini-PC at CES 2024 (fave.co/ 3SgpvP1)—and yes, we've all seen mini-PCs before, but this one is a little different, with a choice of Intel Core Ultra 9 or Core Ultra 7 processors, Nvidia RTX 4060 or 4070 GPUs, and up to 32GB DDR5/5600MHz RAM. It's got me salivating at the prospect of the kind of high-end gaming I'll be able to do on a PC whose case is an apartment-friendly 2.5 liters in volume.

Although small, the ROG NUC's connectivity looks state of the art, too. The desktop has Wi-Fi 6E and Bluetooth 5.3, and no less than six USB-A ports, a Thunderbolt 4 port, HDMI port, 2x display ports, dual 3.5mm audio jacks, and a full-size SD card reader. No word from Asus about pricing yet, so fingers crossed it will land in a hip-pocket-friendly price zone.—*Dominic Bayley*

minutes and boom! You now have enough juice for 30 minutes. It's definitely an interesting concept that speaks to the prepper zeitgeist, but I'm not sure if it'll ever be ready for liftoff. After all, if the battery is dead, why not just plug into the PC?
—*Ashley Biancuzzo*

5. ROG NUC GAMING PC

Having a third kid in 2023 was a great joy, but it does mean space is now getting a little tight around my apartment. Suddenly, my giant gaming rig is looking a little oversize—like the equivalent of Hollywood's iconic sign lumped on the floor between a pile of garish-looking soft toys and (definitely now a

6. DUAL-SCREEN LAPTOPS (LENOVO YOGA BOOK 9I AND ASUS ZENBOOK DUO)

I love screen real estate—and so I've always hated long sessions on just a laptop. But two new dual-screen notebooks shown at this year's CES are making me rethink my stance— they offer the multi-monitor experience without the hassle of actually packing and setting up a portable display. I'm partial to Lenovo's Yoga Book 9i (fave.co/3U6mnqp), which is a bit smaller and offers more flexibility with the detachable keyboard's positioning, but the equally luxe yet cheaper (by $500!) Asus Zenbook Duo (fave. co/3tLAcQi) looks just as tempting. Although I don't need a new laptop, now I really want one.—*Alaina Yee*

The two full-size OLED screens on Lenovo's brand-new Yoga Book 9i laptop are absolutely stunning and versatile as hell. You can use it like a conventional clamshell laptop or a

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dual-screen PC setup. If you're going for the latter, the screens can be positioned either horizontally or vertically. The whole package weighs just under 3 pounds as well, which is impressive given the additional display. It even features the latest 14th-Gen Intel Core U-class CPU and a maximum of 32GB of RAM and 1TB of SSD storage. I'm looking forward to trying out this device myself.—*Ashley Biancuzzo*

7. ASUS BTF ECOSYSTEM

We declared the War on Cables the hottest PC trend of 2023 (fave.co/420WCtd) after Computex last summer, and at CES 2024, the concept got real. MSI and Maingear were busy showing off their Project Zero initiative for a cable-free desktop PC, but Asus' rival concept—dubbed BTF, for "Back to the Future"— impressed me the most.

While all these concepts move most wiring to the back of the motherboard for a pristine aesthetic, only Asus uses a proprietary 600W PCIe high-power connector on its graphics cards as well, letting you slot them into the motherboard without any power cables poking out from the front side, for a truly wireless interior (well, except the tubing for AIO CPU coolers, natch). It's a wickedly clean look, though Asus motherboards will still work just fine with any GPU if you'd like.

new handheld console capable of playing your old Sega Genesis cartridges. Modeled after a Genesis controller, it comes with a 5-inch screen and up to 10 hours of battery life. The screen will also be capable of toggling between 4:3 and 16:9 aspect ratio modes. Eat my shorts, *Genesis Nomad*.

This new Mega 95 is seemingly a handheld version of Hyperkin's MegaRetroN HD console (fave.co/3O5HC7U), but with some upgrades. Not only will it allow you to take your games on the go, but it also comes with a dock to connect to your TV via HDMI and two ports for controllers. Get ready to fire up *Sonic* again and finally collect those last Chaos Emeralds.—*Sam Singleton*

Asus expects to start selling bundled BTF kits (motherboard, graphics card, case) under its TUF brand sometime around February, while a higher-end ROG Strix BTF bundle will land late in this quarter. Even better, Asus has already signed up nine case partners—including heavyweights like Corsair, Lian Li, Cooler Master, Silverstone, and BeQuiet—who've pledged to support the BTF project. The War on Cables is beginning in earnest.
—*Brad Chacos*

8. HYPERKIN MEGA 95

Grab those baggy pants, flip your hat backward, and dust off the old boxes of Sega Genesis cartridges. Hyperkin is here with the Mega 95, a

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10. LENOVO THINKBOOK PLUS GEN 5 HYBRID

CES 2024 had its fair share of interesting laptop configurations and form factors—take the two multi-monitor laptops above as prime examples—but Lenovo's ThinkBook Plus Gen 5 Hybrid offers its own very unique take on the genre. As a Windows laptop, the specs are pretty standard: Core 7 Ultra CPU, Arc graphics, 32GB RAM, 1TB storage. What makes it stand out is how cleverly it functions as both a Windows

9. THERMALTAKE TOWER 300

The Thermaltake Tower 300 stood out in a sea of "just another box" PC cases this year. No six sides here, we're talking *octagonal*, with wicked airflow from bottom to top, unless you've got it on its side with the optional stand that is giving me real Doom Slayer power-up vibes. The real kicker here is that while the Tower 300 can support MinilTX motherboards, it's designed around the MicroATX form factor, which is something we haven't seen much of lately. Oh, and if you don't like the Thermaltake 25th Anniversary Blue, you can opt for traditional white and black—but also yellow, green, and turquoise!—*Keith May*

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laptop, when the 14.5-inch OLED panel is docked in the keyboard, or as a conventional Android tablet when the panel is undocked, complete with a built-in Snapdragon processor, 12GB of RAM and 256GB of storage, and support for touch or pen input.

Yes, all the PC parts are in the keyboard! That means the keyboard itself can be attached to a large monitor to form yet a third configuration that's suited to stationary desktop work. How clever is that?—*Katherine Stevenson*

11. 2024 RAZER BLADE 16

Every year Razer's Blade 14 gaming laptop leaves me a little awestruck. Its portability, power-to-size ratio, and the quality of its visuals just seem to all meld together perfectly—plus, it arguably offers the best bang for buck in Razer's lineup. This year, however, it's the laptop's larger sibling, the Razer Blade 16, that really caught my eye. The reason? Its OLED display.

I've been waiting for OLED displays to come of age and to go one better than the 15-inch QHD 240Hz display we saw in the 2023 Razer Blade 15, and the Blade 16 does just that, upping the ante to a whopping QHD+ (2560×1600) OLED display with a 240Hz refresh rate in a larger 16-inch panel, in what Razer claims is the first of its kind ever made. Larger, more fluid, even more gorgeously rendered OLED visuals? Yes, please!

Under the hood, the top-tier Blade 16 also looks absolutely ripped, with a 14th-gen Intel Core i9 14900HX CPU and GeForce RTX 4090 GPU onboard. It's loaded with the kind of hardware that could make me a legend, if not a demigod, in games like *Counterstrike 2* and *Fortnite.*—*Dominic Bayley*

12. ALIENWARE AW3225QF OLED MONITOR

Dell has already made a splash in gamer circles with its OLED ultrawides, combining the much-sought-after premium panel with

surprisingly attainable prices. But the 32-inch Alienware AW3225QF might just become the large-format monitor of choice for desktop and laptop users who want to revel in both games and standard media. Its 4K resolution and 240Hz speed mean it's ideal for showing off both PC and console games at their best, with a 1,000-nit peak brightness that makes it the better of many OLED monitors already on the market.

With a subtle curve, ultra-thin panel, and both HDMI and DisplayPort 2.1 options, it boasts both looks and capability. I also dig the bottom-mounted USB-A and USB-C ports, all the easier for plugging in a phone or accessories. While it doesn't have the lightning speed of the smaller Alienware 27-inch OLED (also on display at CES), it's

certainly a showpiece for anyone who's built a desk setup with a focus on visual splendor. The AW3225QF is currently available from Dell's online store (fave.co/4aOXUeW) for $1199.99.—*Michael Crider*

13. MEMRYX MX3

The MemryX MX3 is the first third-party AI accelerator card to land in a PC. The company's debut effort may be of modest value (MemryX claims 40 TFLOPs per card, which isn't that different than some of the NPU power that chip vendors currently boast.)

But we may be on the cusp of a moment where a new generation of AI chip startups launches AI accelerator cards for the PC. Lenovo is already planning to include them

in a ThinkCentre desktop (fave.co/3O2INVn), and says there are more out there than we've heard of. MemryX may not be the best of this bunch, but it's at the surface of a movement that may alter the landscape of the PC.

—Mark Hachman
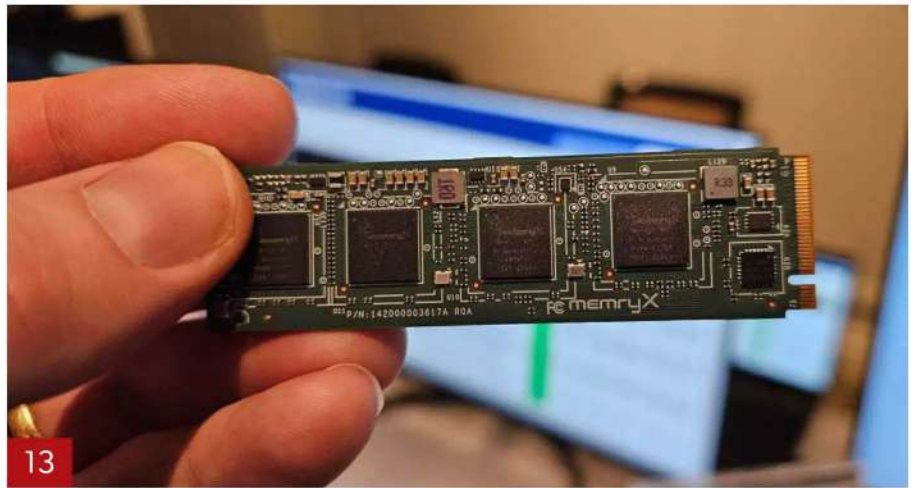
14. HARDWARE WE COULD DO WITHOUT: TRANSPARENT TVS

I saw transparent screens at CES more than a decade ago. They were just as dumb then as they are now. Outside of some extremely niche applications in advertising and public signage, there's simply no reason a consumer would want to look at both a TV or monitor-size screen (with a worse image than a standard one) and whatever's behind it, which is usually a blank wall. There are uses for this technology—smart glasses come to mind, to say nothing of heads-up displays in all kinds of vehicles. But trying to put them in consumers' homes reeks of an industry desperate for a gimmick to push.*—Michael Crider*⏻

Audio Radar gives hearing-impaired gamers a fair shot

Audio Radar translates 7.1 surround sound output into visual cues to help hearing impaired gamers compete. **BY BRAD CHACOS**

The tagline for Audio Radar (fave. co/47CwUwy) says it all: "Hear everything with your eyes." This inspiring new gaming product knocked my socks off at CES 2024. It helps hearing-impaired gamers compete in games where sound location is crucial, such as *Call of Duty* and *PUBG*.

Created by a company called AirDrop, Audio Radar is a plug-and-play hardware system that works with consoles and the PC alike. It consists of six customizable RGBW light bars that connect all around your monitor or television, then tie into a central command center laden with buttons. By connecting your PC's or console's HDMI output into the command center, and then routing another HDMI cord from the command center to your display, Audio Radar taps into the output 7.1 surround sound signal

IMAGE: FOUNDRY

and uses it to light up the appropriate bars whenever a sound is detected in that direction.

By default, green lights indicate faraway sounds, while yellow and red lights let you know when actions happen closer. With two bars at the top of the display, two on the bottom, and one each on each side, they flare up individually as necessary to let hearing-impaired gamers know where things are going down offscreen. (Both the left-side and top-left light bars will light up when it hears something at a 45-degree angle from the player, for instance.)

The helpfulness of this can't be stressed enough. Situational audio awareness is critical in games, and especially in esports games like *Call of Duty*, *PUBG*, or *Counter-Strike*. If an enemy hears you coming from the left, they can easily get the drop on you. That competitive advantage hurts hearing-impaired gamers, but Audio Radar helps even the playing field.

The sturdy, seemingly well-made command center includes a variety of options that let you fine-tune the specifics of how the system works. Not only can you customize the colors used for directional indicators (helpful for

Audio Radar let me know noise was coming from far ahead, letting me get the long-distance drop on this PUBG training bot during a demo.

color-blind gamers), but you can also adjust the lightform patterns used when audio is detected, adjust the noise-detection sensitivity of the front, side, and rear bars (to keep it from going off constantly in smaller, tighter maps), save chosen presets, and more. It also features a "selfie mode" that shines all the bars in a bright white, or you can choose

The command center includes a variety of options that let you fine-tune the specifics of how the system works.

to set the light bars to stay active in a dimmed mode for a Phillips Hue–esque mood when you aren't actively gaming.

Since Audio Radar simply taps into existing 7.1 surround output via HDMI, it should work out of the box with virtually all modern systems and games, no additional software or tinkering required. Rad.

AirDrop CEO Tim Murphy hopes this is just the beginning, however. At CES, he showed me a new mod available for Minecraft that lets you color-code the light bar output for hostile and neutral mobs; Sheep and cows appeared green on Audio Radar's light bars, while a wandering Ender Dragon appeared in purple, so you can tell at a glance whether you need to be worried about a given sound indicator. Eventually, he hopes to work with game engines and studios to integrate Audio Radar's technology

so similarly tuned visual indicators would work with more games.

Even as it stands today, however, Audio Radar could be a massive quality-of-life boost for hearing-impaired gamers, or for full-hearing gamers who like to play with the sound low or simply want a visual indicator of where sounds are coming from for increased situation awareness. I could see sweaty esports competitors or people who game after the rest of their household goes to bed loving something like this.

That's important to making this intriguing piece of accessibility tech more accessible, too. Audio Radar launched in mid-December for $399 and immediately sold out of its initial batch of several hundred units, with overwhelmingly positive reviews thus far. You can preorder one of your own (fave.co/3S0rZPZ) right now from the next batch. If it sells well, Murphy says manufacturing scale would kick in and help make it even more affordable.

I hope that happens. This could be truly transformative technology for hearing-impaired gamers, and as the Audio Radar website says, every gamer deserves a fair shot. Microsoft's been pushing hard on the accessibility front in recent years. Hey, Xbox chief Phil Spencer, check out Audio Radar! ⏻

See how the Ender Dragon in front is indicated by a purple light, while the green light in the bottom left tells you where a non-hostile chicken is clucking in *Minecraft*.

Thunderbolt 5 hardware revealed at CES: When will you get it?

J5create, Hyper show off their first planned Thunderbolt 5 docks. **BY MARK HACHMAN**

We know that Thunderbolt's next major iteration, Thunderbolt 5, will debut sometime in 2024. Two vendors, J5create and Hyper, showed off their first hardware at CES 2024. But there are two big questions: When will you actually get it and how much will it cost you?

The answer? It depends. Both J5 and Hyper representatives told PCWorld they received their prototype hardware just Sunday, and a J5 representative said he was optimistic that his company's first product would ship in March. Others weren't so sure about the timing.

Thunderbolt is a more powerful I/O alternative to the generic USB-C connection found within most laptops. Though a 10Gbps USB-C connection can be used to drive a USB-C hub or dongle (fave.co/30z4JBG) to add ports to your laptop, the 40Gbps Thunderbolt 3/4 connection allows for multiple high-speed displays via a Thunderbolt dock (fave.co/3vtA0BE).

Thunderbolt 5 (fave.co/3txpsEA) doubles that throughput to 80Gbps, and in some cases

offers a one-way connection that can hit 120Gpbs. That will allow consumers to add one or more high-speed displays to their laptop. Thunderbolt 4 allowed you to connect two 4K displays, at 60Hz. Thunderbolt 5 increases that to support three 4K displays, at 144Hz each.

The problem is that Thunderbolt requires device support in your laptop or desktop PC. Intel has said previously that Thunderbolt 5 will be supported in its 2024 product lineup, but as a discrete chip: That means that laptop OEMs will pay more to add Thunderbolt 5 to their laptops, and by extension, so will you. It will also likely sap a bit of power from your laptop's battery.

We still don't know when either the Thunderbolt host controller or the device controller will ship. But with the first Thunderbolt controllers already in prototype hardware, we can be optimistic.

THE FIRST THUNDERBOLT 5 DOCKS, REVEALED

J5create, also known as J5, showed off the Thunderbolt 5 Dual 8K60 Display Dock at the CES Unveiled show. It will be priced at $499, a representative said, and likely available for consumers to buy in March.

It's not quite clear what the specific features of the J5 device will be, but it appears that it will lean into the existing Mac market for Thunderbolt displays as well as the emerging USB-C/Thunderbolt monitor market (fave.co/3RXrfvc) for Windows devices. It has two Thunderbolt 5 ports on the front, a microSD/SD card slot, a mic/speaker jack, and a 10Gbps USB-A port. On the back, there's a power input, a 2.5Gbps Ethernet jack, two USB-A ports (5Gbps and 10Gbps), and a third Thunderbolt 5 upstream port, combined with the downstream connection to your PC. It's worth noting that Thunderbolt 5 does allow for up to 240W downstream charging to your laptop, but J5 plans to support 140W charging instead.

Hyper, the more consumer-focused imprint of Targus, also revealed the

The J5create Thunderbolt 5 dock focuses on Thunderbolt as a display interface.

Hyper's first Thunderbolt 5 dock, the TB5.

Hyper TB5 Dock, which it plans to sell for $399, a representative said.

Hyper's TB5 dock looks similar. There, Hyper's TB5 Dock offers both a microSD card and SD card slot, alongside two upstream Thunderbolt 5 ports. There's also a 10Gbps USB-A port and a mic/headphone jack.

On the rear, this triple display dock offers two DisplayPort ports and an HDMI port, the specifications of which weren't clear. There is also an Ethernet connection. On the rear, there is a pair of USB 3.2 Type A ports (at 10Gbps apiece) as well as a Thunderbolt 5 port.

And there was a hidden surprise in both docks, too: a small foldout port for an M.2 SSD card, making them Thunderbolt dock enclosures as well.

Bernie Thompson, the chief technical officer of dock maker Plugable Technologies, told

PCWorld he expects Thunderbolt 5 hardware to be available "towards the end of the year."

Plugable launched the TBT4-UD5 Monday at CES 2024, which he said could be one of the company's last Thunderbolt 4 docks. The TBT4-UD5, priced at $199 (fave.co/4aQGBdD), pairs two HDMI ports with a downstream Thunderbolt 4 port, a 10GBps USB-C port, four USB-A ports (two at 10Gbps and two at 5Gbps), microSD/SD card readers, and a 3.5mm jack. It delivers 96W downstream to your notebook.

Plugable's Thompson said that it's pretty clear HDMI has won out as the I/O connection interface of choice, though he noted that the embedded DisplayPort protocol actually is the Thunderbolt transfer medium. ⏻

The front of the Hyper TB5 dock.

Why doesn't Windows have a decent PDF editor?

Come on, Windows. **BY ANDERS LUNDBERG**

n recent weeks, I've had the pleasure of familiarizing myself with the many PDF reading and editing programs available for Windows. But it hasn't been an enjoyable experience. Not that there aren't any decent programs out there—there are several that work well. But time and time again, I'm struck by how lucky I've been to be a regular Mac user.

Mac OS has had a built-in program for simple PDF editing ever since Mac OS X first saw the light of day in 2001. Microsoft has had 22 years to take inspiration from Apple, but Windows still lacks a proper PDF program. Fortunately, the new Edge has a decent PDF viewer that can also be used to mark up and annotate, but adding and deleting pages requires third-party software.

In fact, after testing about 10 programs, including Adobe's Acrobat Pro, I haven't found anything that's as easy or as smooth as Apple's Preview, especially for simple editing. For example, copying a page from one PDF to another takes a few seconds with

drag-and-drop in Apple's program. No Windows program comes close.

Another thing these programs can't do is copy text from PDFs without line breaks. Select, copy, paste—how hard can it be? But in everything from Acrobat to free programs like PDF Gear and Ashampoo PDF, the pasted text gets line breaks or a new paragraph after each line, resulting in a lot of extra work. Preview manages this brilliantly in 99 out of 100 cases.

UNHOLY ALLIANCE BETWEEN MICROSOFT AND ADOBE?

Microsoft hasn't commented on the matter, but if there's a common theory as to why this is the case, it's that the company (at least in the past) had a fear of being targeted by competition authorities, as happened with Internet Explorer.

In the mid-2000s, Adobe threatened to report Microsoft to the European Commission if the company baked "save as PDF" functions into Office programs, but the situation is not quite so tense today. Windows has long had a built-in virtual PDF printer that Adobe doesn't seem to have a problem with. In addition, Microsoft has added several other new programs and features to Windows that previously could have met the same complaints about unfair competition with third-party developers.

That leaves another possible, more sinister explanation: Microsoft has simply chosen not to step on Adobe's toes in order to promote its good cooperation with the Photoshop developer. If that's true, it may have made sense 15 years ago, but today it's something all ordinary Windows users have to suffer with. The only winner is Adobe, which can continue to sell Acrobat with all its advanced features to users who may only need to merge and rearrange their files.

NOTHING WRONG WITH IMITATION

When someone does something really good in software, it doesn't take long for others to follow suit. Those who are negative call it plagiarism or copying. A more positive view is that these developers are taking inspiration and learning. Apple and Microsoft have mimicked each other many times over the years, to the benefit of users of both operating systems. I'm not the only person wondering why Windows has no alternative to the Mac's Preview. Search Reddit or any other forum for computer enthusiasts and you'll find many more users who agree.

Apple doesn't have a patent on the ideas for how a PDF editor can work, so how it can go over 20 years without any Windows developer even looking at Preview and doing something similar is a mystery to me. The only explanation in my mind is that no one is willing to pay for something that can only do basic editing but does it very well. In that case, the hope lies with Microsoft. ⏻

Nvidia's RTX 40-series Super GPUs make GeForce great again

Nvidia's new Super GPUs are what the GeForce RTX 40-series should have been to begin with. **BY BRAD CHACOS**

Nvidia unveiled a trio of new RTX 40-series Super graphics cards during its CES 2024 virtual keynote. Nvidia introduced the Super branding for the RTX 20-series, and these new ones match their predecessors in more than name. Like the RTX 20-series before it, the RTX 40-series is a fantastic reset for Nvidia's modern GeForce lineup, which is often bemoaned for its lack of value.

The GeForce RTX 4070 Super, RTX 4070 Ti Super, and RTX 4080 Super each boasts very different alterations, but each fixes the most significant drawbacks of its non-Super namesake. These Super GPUs are what the RTX 40-series should have been from the get-go. Let's dig in.

1. NVIDIA GEFORCE RTX 4080 SUPER

The most ferocious Super upgrade of the bunch is actually the most modest. The original $1,200 GeForce RTX 4080 was built around Nvidia's AD103 GPU die with two SM clusters disabled. (Think of SMs as the

VIDEO: **NVIDIA REVEALS RTX 40 SERIES SUPER GPUS AT CES**
Watch now at fave.co/3TTW5rc

IMAGE: NVIDIA

building blocks of GeForce GPUs, with each housing a set number of CUDA cores, ray tracing cores, and so on.) The RTX 4080 Super enables those last two SMs, as well as faster 23Gbps memory, delivering performance 2 to 3 percent faster than the original 4080 in most circumstances.

That's kinda ho-hum. So, what's the big deal? The price. The original RTX 4080 cost a chest-clutching $1,200, instantly earning our ire (fave. co/40gi3UE) despite its ferocious capabilities. The GeForce RTX 4080 Super costs $999 (it launched on January 31). That's still the official MSRP of AMD's rival Radeon RX 7900 XTX, and at the same price, AMD's GPU no longer makes Nvidia's look silly. I can't wait to get this puppy in my test bed. (Note that all Nvidia-supplied performance charts in this article include games with a mixture of DLSS, ray tracing, and DLSS 3 Frame Gen enabled.)

2. NVIDIA GEFORCE RTX 4070 TI SUPER

Speaking of things I can't wait to test out, enter the GeForce RTX 4070 Ti Super. It launches at the same $799 price as the non-Super version, albeit with a sillier name.

GEFORCE RTX 4080 SUPER - MORE CORES, FASTER MEMORY

	RTX 4080 SUPER	RTX 3080 Ti	RTX 2080 SUPER
Shader Cores	Ada Lovelace 52 Shader TFLOPS	Ampere 34 Shader TFLOPS	Turing 11 Shader TFLOPS
RT Cores	3rd Gen 121 RT TFLOPS	2nd Gen 67 RT TFLOPS	1st Gen 34 RT TFLOPS
Tensor Cores	4th Gen 836 AI TOPS	3rd Gen 273 AI TOPS	2nd Gen 89 AI TOPS
DLSS	3	2	2
NV Encoders	AV1 / H.264	H.264	H.264
Frame Buffer	16GB G6X	12GB G6X	8GB G6
Memory Subsystem	64MB L2 736 GB/sec	6MB L2 912 GB/sec	4MB L2 496 GB/s
Average Gaming Power	246W	352W	227W
Video Playback Power	22W	27W	17W
Idle Power	15W	13W	10W
TGP	320 W	350W	250W

SUPER UPGRADE

1

But once again, Nvidia fixed the worst problem with the original 4070 Ti with this Super update: its memory configuration.

The 4070 Ti earned my worst review score of 2023 (fave.co/40h209p), along with a firm tongue-lashing, thanks to its combination of a sky-high price with a neutered 192-bit memory bus that made it poor for 4K gaming.

"At $799, the GeForce RTX 4070 Ti costs $100 more than last generation's stunning RTX 3080—and it's a lower-tier GPU," I wrote.

GEFORCE RTX 4070 Ti SUPER – MORE CORES, MORE MEMORY

	RTX 4070 Ti SUPER	RTX 3070 Ti	RTX 2070 SUPER
Shader Cores	Ada Lovelace 44 Shader TFLOPS	Ampere 22 Shader TFLOPS	Turing 9 Shader TFLOPS
RT Cores	3rd Gen 102 RT TFLOPS	2nd Gen 43 RT TFLOPS	1st Gen 27 RT TFLOPS
Tensor Cores	4th Gen 706 AI TOPS	3rd Gen 174 AI TOPS	2nd Gen 73 AI TOPS
DLSS	3	2	2
NV Encoders	AV1 / H.264	H.264	H.264
Frame Buffer	16GB G6X	8GB G6X	8GB G6
Memory Subsystem	48MB L2 672 GB/sec	4MB L2 608 GB/sec	4MB L2 448 GB/s
Average Gaming Power	226W	240W	205W
Video Playback Power	17W	20W	15W
Idle Power	12W	12W	11W
TGP	285 W	290W	215W

2

GPU originally earmarked for the 4080. With it comes not only a welcome 10 to 11 percent performance uplift over the vanilla RTX 4070, but also a beefier memory subsystem. The RTX 4070 Ti Super upgrades to a 16GB of VRAM capacity (up from 12GB) and, better yet, a 256-bit memory bus (up from 192 bits).

That means it should handle both 1440p and 4K gaming *very* well. Again: If Nvidia wants to charge a $799 price for a graphics card, *this* is what it should've been to begin with.

3. NVIDIA GEFORCE RTX 4070 SUPER

The $599 GeForce RTX 4070 Super carries the same price tag as its predecessor yet provides the biggest performance bump of them all. Nvidia infused this Super-fied 4070 with 20 percent more CUDA, ray tracing, and RT cores, which should provide a corresponding (though not universal) performance boost in many games.

The powerful yet power-efficient RTX 4070 (fave.co/4265ONe) was one of the highlights of the original RTX 40-series lineup, even though we thought it was priced too high. The Super's juicy performance bump will no doubt temper

"It's $200 more than the already-overpriced RTX 3070 Ti was. In exchange for that 14 percent price hike over the 3080, you usually get a stagnant 14 percent more performance than the 3080 at 4K, or roughly 20 percent faster speeds at 1440p. Nvidia cut the 4070 Ti's memory bus back to RTX 3060 levels which slows it down at 4K. That's flat-out unacceptable in a *$799 graphics card*."

Nvidia didn't touch the price with the RTX 4070 Ti Super, but it fixed the gruesome memory issue by swapping in the AD103

RTX 4070 SUPER – 20% MORE CORES

	RTX 4070 SUPER	RTX 3070	RTX 2070
Shader Cores	Ada Lovelace 36 Shader TFLOPS	Ampere 20 Shader TFLOPS	Turing 8 Shader TFLOPS
RT Cores	3rd Gen 82 RT TFLOPS	2nd Gen 40 RT TFLOPS	1st Gen 24 RT TFLOPS
Tensor Cores	4th Gen 568 AI TOPS	3rd Gen 163 AI TOPS	2nd Gen 63 AI TOPS
DLSS	3	2	2
NV Encoders	AV1 / H.264	H.264	H.264
Frame Buffer	12GB G6X	8GB G6	8GB G6
Memory Subsystem	36MB L2 504 GB/sec	4MB L2 448 GB/sec	4MB L2 448 GB/s
Average Gaming Power	200W	215W	177W
Video Playback Power	16W	20W	18W
Idle Power	11W	11W	10W
TGP	220 W	220W	185W

SUPER UPGRADE

3

(fave.co/3t5oYWu), *sometimes* besting the $600 RTX 4070 Super by 15 to 20 percent. This Super tweak will likely narrow (or eliminate) that gap, while Nvidia can pitch the advantages of software features like DLSS 3, Frame Gen, and the AI-powered Nvidia Broadcast on why the Super still costs a premium over its AMD rival.
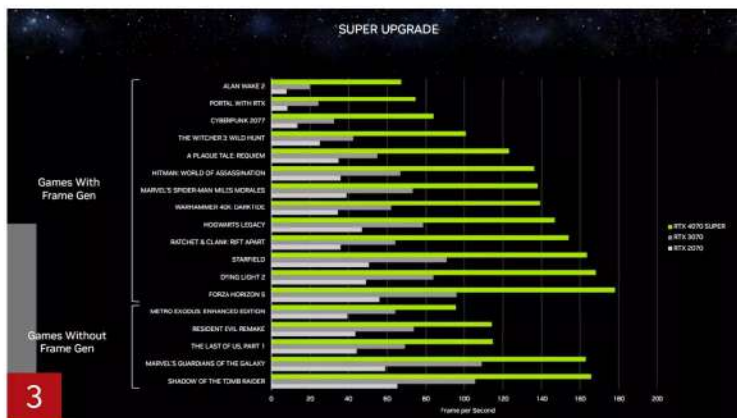
WHAT ABOUT THE NON-SUPER GPUS?

Both the original GeForce RTX 4080 and 4070 Ti will be phased out, replaced wholly by their Super replacements.

The non-Super GeForce RTX 4070 will continue to stick around at a new, lower $549 price. That doesn't seem like it'll

that concern somewhat. Nvidia's Brandon Bell told me that the new 4070 Super uses a "nearly" perfect version of the AD104 GPU, which helps it land just 5 percent behind the performance of the original non-Super RTX 4070 Ti. Doing so requires more juice, of course, so the 4070 Super moves to a 16-pin power connector and comes rated for 220 watts of total graphics power.

Bumping the RTX 4070 Super the most is a smart move by Nvidia. In this price segment, the $500 Radeon RX 7800 XT reigns supreme

be very compelling between the $500 Radeon RX 7800 XT and $600 RTX 4070 Super, but Nvidia stressed that the $549 is just official pricing—on the streets, I wouldn't be surprised to see vanilla 4070s going for $500 or less before long, giving their Radeon rivals a true run for their money.

Bottom line: We won't know for sure how Nvidia's new RTX 40-series Super cards handle until they've crossed independent test benches. But on paper, they look pretty, pretty, pretty darned good. ⏻
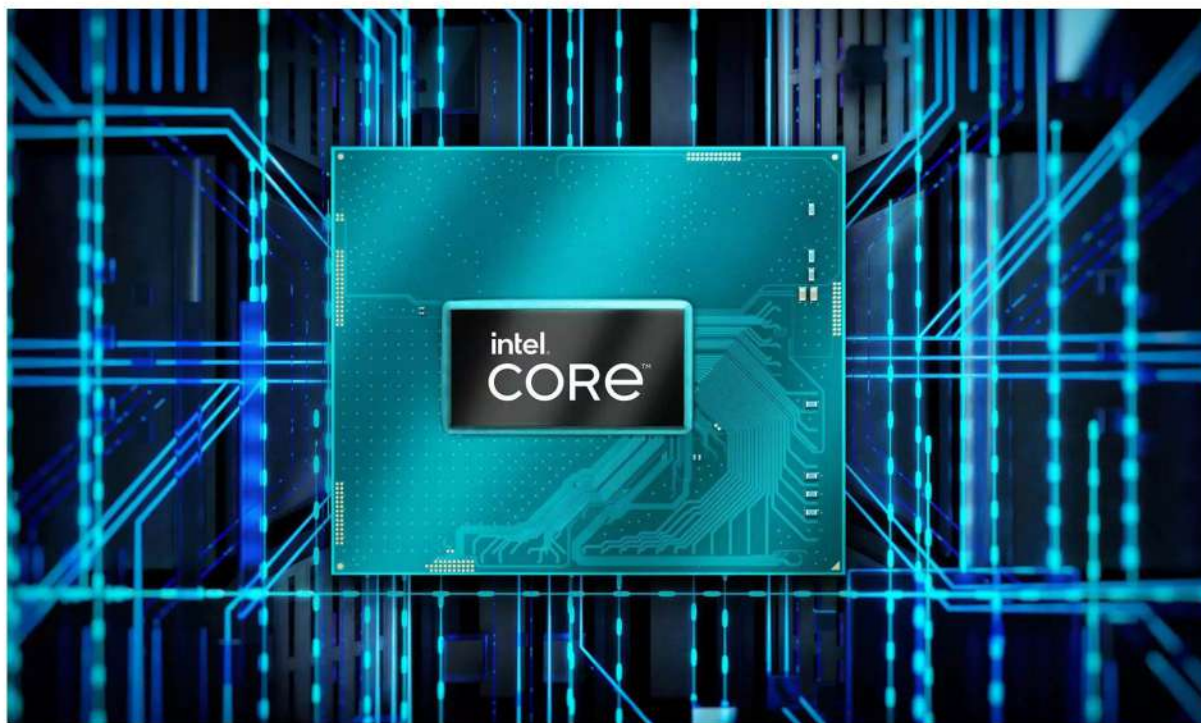
Core HX unleashed: Intel's second 14th-gen laptop family aims at gamers

Meet the 14th-gen mobile Core HX family, which looks very similar to the 13th-gen mobile Core. **BY MARK HACHMAN**

Intel has launched the mobile version of its Raptor Lake Refresh processors for laptops at CES 2024, answering the demands for more performance in its notebook chips. Led by the Intel Core i9-14900HX, the new chip family can hit 5.8GHz, driving desktop speeds inside a gaming laptop. Raptor Lake Refresh powers Intel's 14th-gen desktop series as well, but the company is offering these new processors alongside its much-hyped Meteor Lake Core Ultra chips in laptops.

VIDEO: **INTEL TALKS ABOUT AI AND HX PERFORMANCE**
Watch now at fave.co/4aUucVY

If you already own a 13th-gen Core laptop, however, you may want to pause. These new chips seem awfully familiar, and 14th-gen Core HX laptop owners are likely see much sharper performance improvements compared to the Core Ultra than the 13th-gen mobile parts.

We've barely seen the first Intel Core Ultra laptops debut from Lenovo (fave.co/3TYhhw8) and Acer (fave.co/47DYyct), led by our review of the Acer Swift Go 14 (fave.co/3U2Tyes) and hands-ons of multiple Core Ultra laptops (fave.co/3O3e9ve) performing AI tasks. But Intel hasn't been shy in talking about how the Core Ultra sips power, with an emphasis on long battery life.

It now looks like the Core Ultra will be the engine for all-day productivity laptops, and the new 14th-gen mobile Core HX series will be what you'll buy for Intel-based fast gaming laptops. About 60 HX-based notebooks will ship this year, Intel expects.

The secret? More cores, surrounded by an infrastructure that delivers more data. Intel's Core Ultra processors top out at six performance cores (P-cores) and eight efficiency cores (E-cores) with a pair of low-power E-cores to boot. The Core Ultra Thread Director's management software pushes new tasks to the lowest-power cores first. On the other hand, Intel's 14th-gen mobile chips like the Core i9-14900HX top out with eight P-cores and a whopping 16 E-cores, and it appears new tasks will be routed to the fastest cores first.

While the new 14th-gen Core mobile processors share some overlap with the Core Ultra—DDR5 memory, Bluetooth 5.4/5.3, and integrated Wi-Fi 6E (with support for discrete Wi-Fi 7 cards)—there's one significant upgrade: support for Thunderbolt 5 (fave.co/3txpsEA), which promises 80 to 120 Gbps connections allowing multiple high-resolution displays and likely a resurgence of external GPUs.

Yes, the name is a bit weird—Intel refers to these as the Intel Core processor HX-series (14th gen), or 14th-gen mobile Core HX. But if you keep an eye out for processors like the Core i9-14900HX on the labels at laptops you're looking at, you should be on your way to buying the best performance Intel currently offers.

Between the Core and Core Ultra brands, Intel and its partners will ship more than 750 designs this year, Michelle Johnson Holthaus, executive vice president of the Intel Client Computing Group, said onstage at CES when launching the new chips. Executives from HP, Dell, Lenovo, and more were onstage supporting the launch.

SPEEDS AND FEEDS

Intel has launched five 14th-gen mobile Core HX processors. They're Intel 7 chips, like the desktop version of the 14th-gen Core, Raptor Lake Refresh (fave.co/3SAw5Aj). All of these are 55W parts, though they can ask up to 157W of the laptop when in turbo mode.

Intel® Core™ 14th Gen HX Processors

Processor Number	Processor Cores (P+E)	Processor Threads	Intel Smart Cache (LLC)	Max Turbo Frequency P-cores	Max Turbo Frequency E-cores	Base Frequency P-cores	Base Frequency E-cores	Processor Graphics	Max Memory Speed (MT/S)	Memory Capacity	Processor Base Power (W)	Max Turbo Power (W)
i9-14900HX	24 (8+16)	32	36MB	Up to 5.8	Up to 4.1	Up to 2.2	Up to 1.6	Intel® UHD Graphics	DDR5 5600 DDR4 3200	192GB	55	157
i7-14700HX	20 (8+12)	28	33MB	Up to 5.5	Up to 3.9	Up to 2.1	Up to 1.5	Intel® UHD Graphics	DDR5 5600 DDR4 3200	192GB	55	157
i7-14650HX	16 (8+8)	24	30MB	Up to 5.2	Up to 3.7	Up to 2.2	Up to 1.6	Intel® UHD Graphics	DDR5 5600 DDR4 3200	192GB	55	157
i5-14500HX	14 (6+8)	20	24MB	Up to 4.9	Up to 3.5	Up to 2.6	Up to 1.9	Intel® UHD Graphics	DDR5 5600 DDR4 3200	192GB	55	157
i5-14450HX	10 (6+4)	16	20MB	Up to 4.8	Up to 3.5	Up to 2.4	Up to 1.8	Intel® UHD Graphics	DDR5 5600 DDR4 3200	192GB	55	157

Intel Core i9-14900HX: 24 cores (8 P-cores at up to 5.8GHz,16 E-cores up to 4.1GHz)/32 threads, UHD Graphics at 1.65GHz.

Intel Core i7-14700HX: 20 cores (8 P-cores at up to 5.5GHz,12 E-cores up to 3.9GHz)/28 threads, UHD Graphics at 1.6GHz

Intel Core i7-14650HX: 16 cores (8 P-cores at up to 5.2GHz, 8 E-cores up to 3.7GHz)/24 threads, UHD Graphics at 1.6GHz

Intel Core i7-14500HX: 14 cores (6 P-cores at up to 4.9GHz, 8 E-cores up to 3.5GHz)/ 20 threads, UHD Graphics at 1.55GHz

Intel Core i7-14450HX: 10 cores (6 P-cores at up to 4.8GHz, 4 E-cores up to 3.5GHz)/16 threads, UHD Graphics at 1.5GHz

To be fair, these new 14th-gen HX processors outshine Meteor Lake in terms of performance, but they look awfully similar to the 13th-gen Core chips Intel announced in January 2023 (fave.co/ 3SeSNMj). Take the Intel Core i9-13980HX: 8 performance cores, 16 efficiency cores, with the turbo clock speed of the P-cores hitting 5.6GHz. That chip would slot in rather nicely between the current Core i9-14900HX and the Core i7-14700HX.

Even a closer look doesn't reveal that many changes, though the low-end mobile processors improve. At the low end, the older Core i5-13450HX offered 6 P-cores at 4.6GHz, 4 E-cores at up to 3.4GHz, and UHD graphics at up to 1.45GHz. The Core

For Gaming Laptops and Mobile Workstations
13th Gen Intel Core™ HX Processors

Processor Number	Processor Cores	Processor Threads	Performance Cores	Efficient Cores	L3 Cache	Max Turbo Frequency P-cores	Max Turbo Frequency E-cores	Base Frequency P-cores	Base Frequency E-cores	Processor Graphics	Max Graphics Frequency	DDR5 Frequency	Processor Base Power	Max Turbo Power	Intel vPro® eligible
i9-13980HX	24C	32T	8P	16E	36MB	5.6GHz	4.0GHz	2.2GHz	1.6GHz	32EU	1.65GHz	5600	55W	157W	Enterprise
i9-13950HX	24C	32T	8P	16E	36MB	5.5GHz	4.0GHz	2.2GHz	1.6GHz	32EU	1.65GHz	5600	55W	157W	Enterprise
i9-13900HX	24C	32T	8P	16E	36MB	5.4GHz	3.9GHz	2.2GHz	1.6GHz	32EU	1.65GHz	5600	55W	157W	
i7-13850HX	20C	28T	8P	12E	30MB	5.3GHz	3.8GHz	2.1GHz	1.5GHz	32EU	1.60GHz	5600	55W	157W	Enterprise
i7-13700HX	16C	24T	8P	8E	30MB	5.0GHz	3.7GHz	2.1GHz	1.5GHz	32EU	1.55GHz	4800	55W	157W	
i7-13650HX	14C	20T	6P	8E	24MB	4.9GHz	3.6GHz	2.6GHz	1.9GHz	16EU	1.55GHz	4800	55W	157W	
i5-13600HX	14C	20T	6P	8E	24MB	4.8GHz	3.6GHz	2.6GHz	1.9GHz	32EU	1.50GHz	4800	55W	157W	Enterprise
i5-13500HX	14C	20T	6P	8E	24MB	4.7GHz	3.5GHz	2.5GHz	1.8GHz	16EU	1.50GHz	4800	55W	157W	
i5-13450HX	10C	16T	6P	4E	20MB	4.6GHz	3.4GHz	2.4GHz	1.8GHz	16EU	1.45GHz	4800	55W	157W	

For comparison's sake, here are Intel's 13th-gen mobile Core chips.

i7-14450HX delivers 6 P-cores at 4.8GHz turbo speeds, 4 E-cores at 3.5GHz, and UHD Graphics at 1.5GHz.

None of these new 14th-gen chips contains AI capabilities, unlike Meteor Lake. (Intel launched standalone Movidius AI cards alongside some of the 13th-gen mobile Core chips.) And because these are mobile processors, Intel isn't disclosing prices. Instead, laptop makers will buy them directly from Intel.

## THE ERA OF THUNDERBOLT 5 BEGINS WITHIN INTEL'S 14TH-GEN CORE HX

There are some differences in the supporting I/O infrastructure, though. For one, the Raptor Lake Refresh architecture is built upon the traditional two-die design, with a CPU and an I/O chip. Meteor Lake uses a new tiled architecture.

The new 14th-gen Core HX-series chips will use DDR5-5600 memory, like Meteor Lake (which uses LPDDR5 or LPDDR5X-7469 memory, too). The new 14th-gen HX chips won't be able to achieve those faster speeds, and DDR4 3200 is listed as an alternative memory option instead for 14th-gen HX laptops.

The tradeoff? More lanes of PCIe Gen 5 instead—Meteor Lake includes a 1×8 PCIe 5.0 connection, while the 14th-gen HX platform includes x16 lanes instead. The new 14th-gen HX mobile platform also includes four lanes of PCIe4 off the CPU (plus another 16 off of the I/O controller) and 12 lanes of PCIe 3.0 off the I/O controller, too.

It's possible some of those PCIe 5 lanes could be used for Thunderbolt 5. Intel doesn't list Thunderbolt as an integrated feature of the platform at all, and has listed it as available on select models. Wi-Fi 7 should be available as a discrete option, too, as will Intel's Wi-Fi 7 (5 Gig) BE200 chip, and the Killer 1750x, which will combine WiFi 7 and Bluetooth 5.4.

And on paper, it appears that the 14th-gen HX laptops will fall a bit short of Meteor Lake
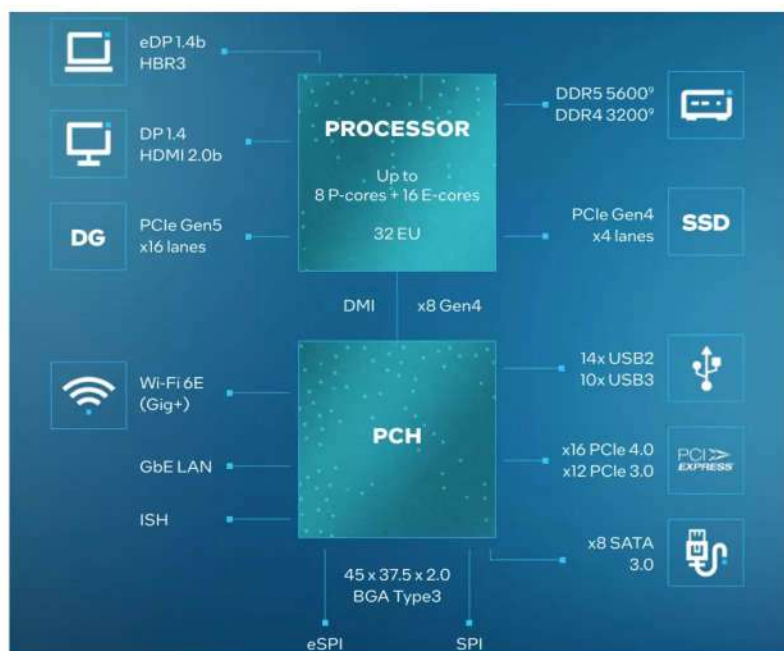
Intel's 14th-gen mobile Core HX system diagram.

Processor Number	Processor Cores (P+E)	Processor Threads	Intel® Smart Cache	Max Turbo Frequency P-cores	Max Turbo Frequency E-cores	Base Frequency P-cores	Base Frequency E-cores	Processor Graphics	Max Memory Speed (MT/S)	Memory Capacity	Processor Base Power (W)	Max Turbo Power (W)	Intel vPro Essentials
Intel Core 7 processor 150U	10 (2+8)	12	12MB	5.4	4.0	1.8	1.2	Intel Graphics	DDR5 – 5200 LPDDR5/x– 6400	96GB	15	55	√
Intel Core 5 processor 120U	10 (2+8)	12	12MB	5.0	3.8	1.4	0.9	Intel Graphics	DDR4 – 3200 LPDDR4x – 4267	96GB	15	55	√
Intel Core 3 processor 100U	6 (2+4)	8	10MB	4.7	3.3	1.2	0.9	Intel Graphics	DDR5 – 5200 LPDDR5/x–5200 DDR4 – 3200 LPDDR4x – 4267	96GB	15	55	

Intel's 14th-gen Core U-series specifications.

in terms of display I/O. While the Core Ultra/ Meteor Lake supports DisplayPort 2.1 and HDMI 2.1, the 14th-gen HX tech supports just HDMI 2.0b and DisplayPort 1.4.

By gambling on DisplayPort 1.4 (as well as embedded DisplayPort 1.4, also supported) Intel is betting gamers won't want anything more than 4K120Hz native outputs, rather than the 4K240 option DisplayPort 2.1 (or 8K60) provides. HDMI 2.0b can only support 4K60 resolution, or 1440p outputs at 120Hz.

But there's a slight wrinkle. The 14th-gen HX platform supports High Bit Rate 3 (HBR3) a lossless compression standard. Provided

the output supports it, HBR3 works with DisplayPort to provide (lossless) compressed video at up to 8K60 using a single monitor.

The 14th-gen HX platform also supports WiFi 6E, (just) gigabit Ethernet, x8 SATA, and 14 USB2 and 10 USB3 connections.

Intel is also carving out a small group of U-class processors into its own special grouping, and it's not quite clear why. We may see these in Chromebooks, or just budget consumer and business-class notebooks. The emphasis here is on battery life, with more weight given toward E-cores than P-cores.

The plus? Support for four Thunderbolt 4 ports. Though you can certainly connect any Thunderbolt 4 port to a Thunderbolt dock, support for four ports means it's likely that you'll see at least one port on either side of your laptop. Snake a few I/O

Intel Core U-series Platform

- eDP1.4b
- HBR3
- MIPI DSI 2.0
- HDMI 2.0b
- Wi-Fi 6E (Gig+)
- SPI w/ THC
- LP4x 4267, LP5/x 6400 DDR4 3200, DDR5 5200²
- 4x TBT4
- 2x4 PCIe Gen4
- 10x USB2
- 4x USB3
- PCIe Gen3 x12 lanes

4x Thunderbolt™¹ 4 Ports
- DP2.1, USB3 20G
- DP1.4, USB3 10G

Discrete Intel® Wi-Fi 7¹ (5 Gig) & Bluetooth® 5.4*
- Intel Wi-Fi 6E (Gig+) & Bluetooth 5.3
  - Low Energy (LE) Audio
  - Wi-Fi based Sensing

cables around your desk and you'll soon appreciate how useful that is.
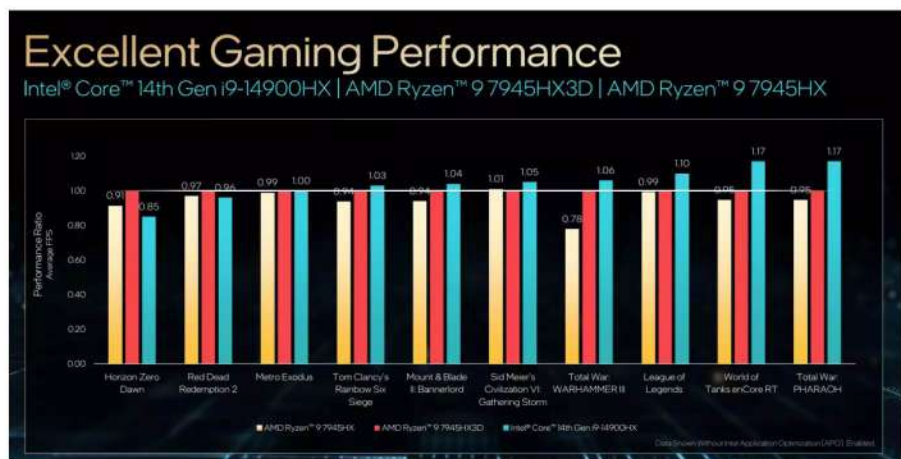
HOW FAST IS THE INTEL CORE HX?

Naturally, Intel is comparing its latest processors to older AMD Ryzen CPUs in making the claim that its latest chips outperform AMD's best. But it's noteworthy that Intel isn't making any gen-over-gen comparisons to its 13th-gen mobile Core chips. While we haven't reviewed the new 14th-gen Core HX platform, it seems possible that we'll see a mild gen-over-gen performance improvement similar to our Intel 14th-gen desktop Core review (fave.co/3TiLt4G).

For reference, our review of the Intel Core i9-13980HX (fave. co/3tUtSG4) performed fantastically compared against Intel's 12th-gen Core parts. At least Intel is bringing in AMD's X3D parts for comparisons. Otherwise, it would be two mobile Core architectures to AMD's one.

All of the new 14th-gen HX platforms are overclockable, and they support Intel's Extreme Tuning Utility for tuning and overclocking memory, as well as Intel's XMP, or Extreme Memory Profile. Intel is also continually tuning applications and games via Intel Application Optimization, and the company says it's added six new gaming titles since October.

We're already seeing gaming laptops announced using the new 14th-gen Core HX chips. Will AMD have an answer? ⏻

All Around Performance
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Intel® Core™ 14th Gen i9-14900HX | AMD Ryzen™ 9 7945HX3D | AMD Ryzen™ 9 7945HX

Top 10 monitors of CES 2024

These are the very best monitors we saw at CES this year. **BY MATTHEW S. SMITH**

CES 2024 was a glorious show for monitors that reinforced the best trends of 2023. A new generation of OLED panels from Samsung and LG hit the show floor, and with them come higher resolutions, higher refresh rates, and improved peak brightness in HDR.

But the show wasn't entirely dominated by big, expensive OLED gaming monitors. Acer brought a 57-inch super-ultrawide Mini-LED and MSI had a practical 24-inch 4K office monitor with USB-C Power Delivery.

These are the best monitors of CES 2024.

1. SAMSUNG ODYSSEY G8 OLED (G80SD)

The Samsung Odyssey G80SD was easily the most important monitor at the show, though not necessarily because of the monitor itself. The spotlight instead shines on Samsung's 4K 240Hz QD-OLED panel. It's a sharp, stunning, high-contrast display with beautiful color and excellent motion clarity, and it will appear in several other monitors in this list.

With that said, there's plenty to like besides the panel. Samsung's Odyssey monitors have veered toward a practical and

professional look in recent years, and that's a plus. The G80SD looks superb and includes a great ergonomic stand that provides a wide range of adjustment but doesn't take up too much space on your desk. The monitor also has two HDMI 2.1 ports, one DisplayPort, and a USB hub (though no USB-C).

Availability and pricing has not been announced. Given the price of other monitors with this panel, however, I expect it to fall between $1,000 and $1,300.

2. SAMSUNG ODYSSEY G6 OLED (G60SD)

If the Odyssey G8 OLED is all about image quality, the Odyssey G6 OLED is all about motion clarity. It retains the 27-inch panel size and 1440p resolution common to OLED monitors in 2023, but kicks the refresh rate up to 360Hz.

It looks super-crisp. OLED panels have a baked-in motion clarity advantage over other panel types thanks to their low pixel response times. Put simply, the pixels on an OLED monitor change more quickly, which in turn reduces motion blur at any given refresh rate. It's not the best available from an OLED (that honor goes to another monitor on this list), but it's excellent. Pricing and availability hadn't

been announced as of this writing, but I expect a price around $1,000 or less.

3. ASUS ROG SWIFT OLED PG27AQDP

The Asus ROG Swift OLED PG27AQDP is a 27-inch 1440p OLED monitor with a frankly shocking 480Hz refresh rate. It's not alone in this accomplishment (LG, which makes the

boosts the peak brightness to 1,300 nits. I'd have to test the monitor firsthand to decide how much of an impact it makes, but I expect HDR movies and games to deliver eye-searing brightness more often.

Unfortunately, you'll have to wait awhile for this display. Asus says it won't ship until the second half of 2024.

OLED panel, also has an as-yet-unnamed 480Hz monitor), but the Asus' variant has a more alluring design.

A 480Hz refresh rate is double the 240Hz common to last year's OLED monitors, and wow, it looks incredible. I can't say with absolute certainty that it defeats 500Hz monitors like the Alienware AW2525HF (fave.co/3O4qDCC), since I haven't viewed them side-by-side, but I'm pretty sure it does. Moving objects look nearly perfect. Fine text remains readable and textures retain even the smallest details.

The display also benefits from LG's Micro Lens Array (MLA) technology, which

4. MSI MODERN MD242UPW

The MSI Modern MD242UPW isn't a monitor you'll hear much buzz about, but I respect a good, well-rounded work monitor. The MD242UPW is exactly that.

Resolution is the monitor's standout specification. 4K is common, but 24-inch monitors with this resolution are few. That's frustrating for people who want a small yet sharp secondary monitor. The MD242UP fills this gap.

It's also packed with useful features including a USB-C port that delivers up to 100 watts of power delivery, a KVM switch, and built-in speakers. These features reinforce the MD242UPW's position as a great choice for productivity, and it should pair especially well with laptops that have USB-C.

Pricing and availability have yet to be announced as of this writing.

5. MSI MEG 321URX

Now for something completely different: MSI's borderline-absurd MEG 321URX. This is a 32-inch 4K 240Hz OLED monitor that uses Samsung's QD-OLED panel, so it's a stunner. The image is sharp, vivid, and smooth.

What sets the MEG 321URX apart, though, is its unusual set of AI features. This includes a lighting element on the chin of the monitor that is designed to detect your health bar in PC games and alter the lighting of the bar to match the health you have left. It also

has a feature called Skysight, which can be used to highlight enemies just off-screen in games like *League of Legends*. The monitor also touts an "AI upgrade" feature, which gamers might put to use for AI features in their favorite games (the details of how this works were thin, however).

The MEG 321URX will retail for $1,799 when it arrives in June or July of 2024.

6. ASUS ROG SWIFT OLED PG39WCDM

Do you think a 34-inch ultrawide is too small, but a 45-inch or 49-inch ultrawide is too large? Asus has you covered with the ROG Swift OLED PG39WCDM. It's a 39-inch curved OLED monitor with a resolution of 3440×1440 and a 240Hz refresh rate. This is another new panel from LG, and as a result, it uses Micro Lens Array

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(MLA) technology to achieve a peak brightness of up to 1,300 nits in HDR.

Although clearly great for gaming, Asus includes a number of practical features. It has a USB-C port with DisplayPort Alternate Mode and up to 90 watts of USB Power Delivery, a KVM switch, and picture-in-picture and picture-by-picture modes. Asus also demonstrated the monitor with a ROG monitor arm, though I'm told it's sold separately.

The Asus ROG Swift OLED PG39WCDM is expected to ship in the first quarter of 2024, but the price has not yet been announced.

7. ACER PREDATOR Z57

Acer's Predator Z57 was among the few new Mini-LED monitors at CES 2024, but it's large

enough to count for two (or three). It has a gigantic 57-inch panel with a resolution of 7680×2160 and a 120Hz refresh rate. It's basically two 4K monitors stuck side-by-side. Personally, I'd love to use it to practice my piloting skills in *Microsoft Flight Simulator*.

The Mini-LED backlight includes a total of 2,304 dimming zones. That's much higher than for most Mini-LED monitors available (512 or 1,024 zones is more common), though they admittedly have more real estate to cover. Still, the backlight should provide excellent brightness in HDR games, and the monitor is VESA DisplayHDR 1000 certified.

Expect to pay $2,499.99 for the Predator Z57 when it arrives in the second quarter of 2024.

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8. GIGABYTE AORUS FO32U2P

The Gigabyte Aorus FO32U2P is another gorgeous new 32-inch 4K 240Hz monitor with a Samsung QD-OLED panel. It provides all the usual benefits, including perfect black levels, vivid color, and a sharp image that retains its clarity at high refresh rates. Gigabyte's claim to fame, however, is bandwidth. It's the world's first DisplayPort 2.1 monitor and can achieve up to 80Gbps of bandwidth without the use of Display Stream Compression (DSC). The monitor also supports daisy-chain connections, which means it's possible to connect additional DisplayPort monitors to the Aorus FO32U2P. That makes the added bandwidth more relevant.

Pricing and availability hadn't been announced as of this writing.

9. VIEWSONIC XG272-2K-OLED

The XGX272-2K-OLED is Viewsonic's take on the 27-inch, 1440p, 360Hz QD-OLED panel also found in the Samsung Odyssey G6 OLED. It performs just as well here. Expect to see near-perfect black levels, vivid color, and excellent motion clarity.

Viewsonic sets itself apart with a few extra features. It officially supports both AMD FreeSync and Nvidia G-Sync (Samsung only lists FreeSync, though I expect it should work with both). The monitor is "Blur Busters Verified" and supports Black Frame Insertion, a technique that can further reduce motion blur.

It's also a debut monitor for a new design language that emulates the modern, white-on-black aesthetic of recent Alienware

content creation and productivity. It's the world's first OLED gaming monitor that can deliver 140 watts of power over USB-C. It also has a "smart KVM switch" that can detect which device you're using and swap on the fly. The monitor is actively cooled as well, a feature HP says should reduce the risk of OLED burn-in.

Features aside, I also think the Omen Transcend is the most attractive of all the 32-inch 4K OLED monitors shown at CES 2024. It pairs a modern white-on-black look with a bright RGB-LED accent light on the rear.

Pricing and availability had not been announced as of this writing. ⏻

monitors. Is it derivative? Perhaps a bit, but it also looks great. And as a final bonus, it comes bundled with a remote that controls the monitor's on-screen menu options.

The XG272-2K-OLED will ship in the first quarter of 2024 for $899.99.

10. HP OMEN TRANSCEND 32

The Omen Transcend 32 is yet another monitor using Samsung's spectacular 32-inch, 4K, 240Hz QD-OLED panel. And yes, it looks absolutely stunning, as is true of all the monitors I saw with this panel.

HP separates this monitor from the pack with a few useful features that focus on

The best laptops at CES 2024

These laptops left a crater-size impression on us. **BY MATTHEW S. SMITH**

CES is a big show for laptops, as many of the best models for the coming year appear first at the show. This year is especially notable, as both Intel and AMD are amid launching new generations of mobile processors (though it does seem most laptop makers are leaning toward Intel). Most of the laptops at CES 2024 looked rather conventional, with a few exceptions, but dial the performance up to 11. There were also a

dizzying array of Mini-LED and OLED displays at the show.

These were the best laptops of CES 2024.

1. LENOVO YOGA 9I PRO 16-INCH (GEN 9)

Lenovo's Yoga 9i lineup was, for my money, the most impressive Windows laptop line of 2023. It had everything: attractive design, a beautiful Mini-LED display, a nice keyboard and touchpad, and good all-around

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Fans of the brand may remember the company has long used magnesium alloy to reduce size and weight, but laptops that used the material required a protective finish that often felt unpleasant or inexpensive. The Thinkbook 13x doesn't have that problem. It's extremely thin and light, measuring just 12.9mm thick and weighing a mere 2.2 pounds to start, but has the metallic look and feel shoppers expect.

performance that included optional Nvidia graphics. Even the pricing was competitive.

The new Yoga 9i Pro 16-inch isn't much different from last year's model, to be honest—but that's fine because it was already great. So what is new? The 2024 model brings Intel Core Ultra processors (up to Intel Core Ultra 9) and a larger 84 watt-hour battery. In short, it's quicker than last year's model yet should last a tad longer on a charge.

The Lenovo Yoga 9i Pro 16-inch Gen 9 will be available in April 2024 starting at $1,699.99.

That's not its only trick. The laptop also supports Lenovo's Magicbay, a family of accessories (including a 4K webcam, 4G hotspot, and studio light) that attach magnetically at the top of the display. The

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2. LENOVO THINKBOOK 13X (GEN 4)

The Lenovo Thinkbook 13x is the world's first laptop with a corrosion-resistant stainless magnesium chassis.

touchpad that looks and feels great. That comes alongside a mechanical keyboard with Cherry MX key switches. It's a hefty laptop as well, with a rock-solid design that looks and feels more elegant than the 2023 model. Make no mistake, however—this laptop is still a bruiser and not meant for frequent travel.

The MSI Titan HX 18 will retail at an MSRP of $4,999 when it arrives later this year.

internal hardware is up to date, too, with support for Intel Core Ultra processors and a 74 watt-hour battery.

The Lenovo Thinkbook 13x Gen 4 will arrive in Q1 2024 for $1,399.

3. MSI TITAN HX 18

MSI's Titan laptops are nothing if not bonkers (fave.co/43RawxU), and the new Titan HX 18 is no exception. The flagship 18-inch gaming laptop comes with 14th-gen Intel Core i9 processors, up to Nvidia RTX 4090 graphics, and a 4K 240Hz Mini-LED display. It also supports up to 128GB of RAM and 6TB of solid state storage.

But the laptop's design deserves equal attention. MSI's new Titan HX 18 has a large, seamless, haptic, RGB-lit

4. HP OMEN TRANSCEND 14

HP went small at CES 2024 with the Omen Transcend 14, which claimed to be the world's lightest 14-inch gaming laptop (a title it lost within hours to the Asus ROG Zephyrus G14, but still). It weighs a feathery 3.6

pounds. The Razer Blade 14 by comparison starts at about 3.9 pounds. The Transcend 14 is a looker, too, with an alluring white colorway and RGB keyboard.

The laptop's specifications are impressive for its size. It packs up to an Intel Core 9 Ultra 185H processor, up to Nvidia RTX 4070 graphics, and a 14-inch 2.8K OLED display with a 120Hz refresh rate and Variable Refresh Rate Support. The laptop is powered by a 140-watt USB-C charger as well, which ships with the laptop.

The HP Omen Transcend 14 is available for pre-order starting at $1,499.99.

5. ASUS ROG STRIX SCAR 18

There's a lot to talk about with the Asus ROG Strix Scar 18, but let's start with the display. As I covered in my preview of Asus' new

laptop displays (fave.co/3tUCqg8), the Strix Scar 18 packs a Mini-LED display with an excellent 2,304 dimming zones. That's more than twice the 1,024 dimming zones last year's ROG Flow X16 offered, and it dramatically boosts contrast in high-brightness scenes. The display is a top performer in other areas, too, with great color accuracy and wide color gamut. Display aside, the Stris Scar 18 has the high-end hardware you'd expect, including up to an Intel Core i9 14900HX processor and up to Nvidia RTX 4090 graphics. RAM tops out at 64GB and solid state storage runs up to 4TB. It's a beefy laptop, weighing in at about 7.3 pounds, but that's to be expected from a gaming laptop with its caliber of hardware.

The Asus ROG Strix Scar 18 starts at $2,999.99 and should ship in the first quarter of 2024.

6. ASUS ZEPHYRUS G16

Next up is the Asus Zephyrus G16 and, once again, the display takes center stage. The new Zephyrus G16 has a 2560×1600 OLED display with a maximum refresh rate of 240Hz. It also crucially supports

hadn't been announced as of this writing.

7. SAMSUNG GALAXY BOOK4 ULTRA

Samsung's Galaxy Book4 Ultra is a 16-inch high-performance thin-and-light with up to an Intel Core 9 Ultra processor and up to Nvidia RTX 4070 graphics. RAM goes up to 64GB and solid state storage peaks at 2TB. It also packs a 2880×1800 OLED touchscreen with a refresh rate up to 120Hz.

All of this hardware is stuffed in an elegant, professional clamshell chassis that tips the scales at roughly 4.1 pounds and

G-Sync, something that wasn't available in OLED laptops prior to those announced at CES 2024. The G16's display looks gorgeous in motion, with crisp detail and deep black levels.

The Zephyrus G16 is otherwise surprisingly practical. It has a rigid machined aluminum chassis that keeps weight down to about 3.3 pounds, and the laptop measures just 0.64 inches thick. Despite its slim profile, it still packs a 90 watt-hour battery. The internals include an Intel Core Ultra 185H processor and up to Nvidia RTX 4090 graphics.

Asus expects to ship the ROG Zephyrus G16 in the first quarter of 2024, but pricing

measures no more than 0.65 inches thick. That's impressive, given the specifications. Samsung also provides a 140 watt USB-C Adapter that can be used to charge the laptop over USB-C.

Samsung hasn't announced pricing, but the Galaxy Book4 Ultra will be available in Korea this month, with other countries to follow soon after.

8. ASUS ZENBOOK DUO

Asus' latest wild dual-screen laptop is the Zenbook Duo, a double-screen clamshell similar to Lenovo's Yoga Book 9i (fave. co/3SfegpX). Like the Lenovo, Asus' laptop provides two OLED touchscreens that can be used in a vertical or horizontal orientation. However, Asus switches things up a notch

with the keyboard and touchpad.

The Yoga Book 9i had a physical keyboard but relied on a virtual touchpad on the lower display, which wasn't great. The Zenbook Duo instead has a larger keyboard with a physical touchpad. As a result, the Duo feels identical to a traditional clamshell laptop when the keyboard and touchpad is in use. Asus also switches up the stand, going for an attached flip-out stand instead of a case.

I'd have to spend more time with the Zenbook Duo to know if Asus' changes put it ahead of Lenovo's competitor, but what I saw was promising. The Zenbook Duo will launch in the first quarter of 2024 at a surprisingly affordable $1,500.

9. ACER ASPIRE VERO 16

Want to go green? Acer's Aspire Vero 16 deserves your attention. It's a follow-up to the company's prior (and apparently quite popular) Vero laptops, which are built from post-consumer resin (PCR) recycled plastics. The Vero 16 ups the PCR content to 60 percent, a big leap from the Acer Aspire Vero

14's chassis, which contained 30 percent. Sustainability aside, I like how the Vero 16 looks. It has a flecked, textured appearance that's unique to the Vero line.

The Aspire Vero 16's specifications are modest, with up to Intel Core Ultra 7 processors, up to 16GB of memory, and up to 2TB of solid state storage. The price tag is also modest: Acer says it'll start at $749.99 and will ship in April 2024.

10. ACER ASPIRE 15 3D SPATIALLABS EDITION

Acer was early to jump on board glasses-free 3D technology with its SpatialLabs sub-brand, and at CES 2024, it showed up at a more affordable price point. The Acer Aspire 15 3D SpatialLabs Edition starts at just $1,399.99, making it the most affordable laptop with the technology yet.

SpatialLabs is Acer's version of a glasses-free 3D that uses cameras to track a user's eyes and provide two slightly different versions of a scene, creating a

stereoscopic effect. No spectacles, dongles, or peripherals are required.

The laptop is also rather well equipped, with up to an Intel Core i7-13620H processor, up to Nvidia RTX 4050 graphics, up to 32GB of memory, and up to 2TB of solid state storage. Acer expects it to ship in February. ⏻

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Acer Swift Go 14: An affordable Intel Core Ultra debut

Getting the Meteor Lake treatment. **BY MATTHEW S. SMITH**

The Acer Swift Go 14 isn't an extravagant laptop but, as the saying goes, it's what inside that counts.

This affordable midrange machine packs Intel's new Core Ultra (fave.co/3U1YPmm) 7 155H processor (aka Meteor Lake), which pairs an impressive core count alongside improved Intel Arc integrated graphics. This new processor, which is made up of separate silicone tiles that have been adhered together, is designed to be more power efficient by offloading tasks to the GPU and NPU. It makes for a capable midrange laptop,

IMAGE: ACER

though battery life still fails to impress. Let's dive right in.

SPECS AND FEATURES

Intel's Core Ultra 7 155H is the star of this show. It delivers a total of 16 cores and 22 threads, an impressive count for any laptop sold below $1,000. Intel's integrated graphics is improved, too, leaping from Iris Xe to Intel Arc and gaining 32 additional execution units in the process.

CPU: Intel Core Ultra 7 155H

Memory: 16GB LPDDR5

Graphics/GPU: Intel Arc integrated graphics

Display: 1920×1200 IPS multi-touch display

Storage: 1TB PCle Gen4 NVMe solid state drive

Webcam: 1440p QHD webcam

Connectivity: 2× Thunderbolt 4 / USB-C, 2× USB-A, 1× HDMI 2.1, MicroSD card reader. 3.5mm audio jack

Networking: Wi-Fi 6E, Bluetooth 5.3

Biometrics: Fingerprint reader

Battery capacity: 65 watt-hours

Dimensions: 14.5×8.5×0.58

Weight: 2.9 pounds

MSRP: $999.99

The Acer Swift Go 14's doesn't skimp elsewhere, either. It has 16GB of RAM, a 1TB solid state drive, a 1440p webcam, and plenty of ports. These features come alongside a price cut relative to the prior model: it had an MSRP of $1,099 with 16GB of RAM and a 512GB SSD, while the new model is just $999.99 for the same amount of RAM and a 1TB SSD

DESIGN AND BUILD QUALITY

The Acer Swift Go 14 is a launch platform for Intel's 14th-gen Core processors, but you wouldn't know that from looking at the laptop. It's a simple, generic silver slate that lacks anything to distinguish it from competitors or previous Acer laptops. This no doubt contributes to the laptop's modest $1,000 MSRP, but it'd be nice to see a little more flair.

Looks can be deceiving, however, and in this case they mask a well-built machine. The display flexes slightly when opened, but it's not excessive, and the chassis' lower half feels rigid. Some laptops, like the Dell XPS 13 or Apple MacBook Air 13, are even more sturdy, but the Swift Go 14 is on par with midrange alternatives like the Asus Vivobook 14X OLED (fave.co/3SfiRsd).

The laptop's standing against competitors improves thanks to a price cut. Past Swift Go 14 models carried an MSRP above $1,000 even for models with less solid state storage, which put the Swift Go 14 uncomfortably close to more luxurious laptops like the Lenovo Slim Pro 7. The Go 14 I received for review had an MSRP of just $999.99 and an entry-level variant with Intel's Core Ultra 5 125H starts at $799.99.

Acer's 14-incher tips the scales at a mere 2.9 pounds—a hair less than many midrange 14-inch laptops—and measures just 0.58 inches thick. It doesn't feel especially svelte in hand, perhaps due to its boxy, angular design, but it's small enough to fit in most bags designed for a 13-inch laptop and light enough for convenient everyday carrying to and from an office.

KEYBOARD, TRACKPAD

A spacious, centered keyboard stretches across the Acer Swift Go 14's interior. The layout is large and provides good spacing between alphanumeric keys. A few modifier keys, like Shift and Caps Lock, are slightly undersize, but no more so than is typical for a 14-inch laptop.

Key feel is a highlight. The Acer Swift Go 14 stands out from competitors with a crisp,

The laptop has a spacious, centered keyboard.

tactile keyboard with a firm and definitive bottoming action. Key travel is lengthy, too, which makes high-speed touch typing more comfortable. It's an excellent experience overall, and one well-suited to users who bang out several thousands words each day.

The numpad is absent, which is typical for a 14-inch laptop. Those who want a 14-inch laptop with a numpad might consider Asus' Vivobook or Zenbook line, both of which hide a numpad in the touchpad.

Acer's touchpad is a mix bag. It's large, responsive, and its texture differs from the surrounding palmrest. The touchpad can feel cramped vertically, however, as it measures a hair more than 5 inches wide but just 3 inches deep. A few 14-inch laptops, like the Razer Blade 14 (fave.co/401YPnl) and Asus Zenbook 14 Flip OLED (fave.co/3u3CDxs), pack a larger touchpad in a similar footprint—though to be fair, those laptops are more expensive. The Swift Go 14's touchpad is fine for the price.

DISPLAY, AUDIO

Acer offers two display options on the Swift Go 14: a 1920×1200 IPS touchscreen and a 2880×1800 OLED display. I received the former, which is a shame, as the IPS display underperforms the OLED alternatives now common in midrange and high-end Windows laptops.

The 1920×1200 display performs well for IPS.

Contrast is the big issue. The 1920×1200 display performs well for IPS with a maximum measured contrast of 1500:1, but that's far short of OLED's near-infinite contrast. I immediately noticed the difference in darker content, as the Swift Go 14's screen can't display deep, inky scenes with convincing depth and detail. Films tend to look flat and games with a darker palette like *Diablo IV* can look murky.

And the IPS display underperforms elsewhere. Its color gamut is more narrow than OLED competitors and its resolution of 1920×1200 obviously underperforms next to a 2880×1800 OLED alternative. The IPS display also lacks the HDR support available with OLED. Brightness is a tad higher than in most OLED displays at 408 nits, but only just: Most OLED laptops have a maximum SDR brightness between 350 and 400 nits.

The IPS display's multi-touch screen does provide one advantage over the laptop's OLED variant. It's not much of an advantage, though, as the Swift Go 14 isn't a 2-in-1 and doesn't fold, twist, or detach for tablet use.

All of this looks bad for the Swift Go 14, but it's mitigated by the available OLED variant. The OLED model with Intel Core Ultra 7 155H carries an identical $999.99 MSRP. It also equips identical memory and storage (16GB of LPDDR5 RAM and a 1TB solid state drive). While I didn't have the chance to test the OLED panel in the Acer Swift Go 14, I reviewed a Swift Go 14 with an OLED panel earlier this year (fave.co/421hXTr) and found it to be the laptop's standout feature. I recommend the OLED model unless you need a touchscreen.

Audio performance, on the other hand, is the same for all Swift Go 14 models—and it's not great. The built-in speakers have adequate volume but suffer a harsh, metallic presentation that becomes grating after a few minutes. External speakers or headphones are recommended when using the laptop.

WEBCAM, MICROPHONE, BIOMETRICS

A 1440p webcam hides in the Acer Swift Go 14's slim top bezel. It provides a sharp, crisp,

clear image with good color reproduction and well-tuned exposure. The image will look grainy in dim lighting, but no more so than other webcams. I also don't like the webcam's viewing angle, which is wide, but that's easy to fix in software and the webcam's 1440p resolution makes it possible to crop the image while maintaining sharpness.

The Acer has a wide selection of ports.

Microphone quality is also solid with good volume and crisp, clear presentation that should help colleagues and co-workers understand you on a video call. Noise cancellation is modest, though, so background noise may creep in.

A fingerprint reader on the Swift Go 14's power button provides biometric authentication. It works well, though, like all fingerprint readers, it becomes unreliable if your finger is even slightly damp or dirty. Facial recognition login isn't supported.

CONNECTIVITY

A pair of USB-C ports with DisplayPort Alternate Mode and USB Power Delivery line the Acer Swift Go 14's left flank. They're joined by two additional USB-A ports (one on each side), HDMI 2.1, 3.5mm audio, and a microSD card reader.

That's more ports than you'll find on many laptops sold in 2023. Asus' Zenbook 14 OLED (fave.co/3SjDWSm) has one less

USB-A port, while Dell's entry-level XPS 13 lacks USB-A. I appreciate Acer's decision to retain a healthy selection of connectivity, and I think most owners won't feel a need to use a dongle or adapter (unless they want a wired Ethernet jack, which isn't included).

Wireless connectivity is just as robust. It includes Bluetooth 5.3 and Wi-Fi 6E, which is the latest Wi-Fi standard. Both connections proved strong in my testing and the laptop's Wi-Fi range was impressive, delivering usable speeds even in my detached office (which is more than 50 feet, and several walls, away from a router).

PERFORMANCE

The Acer Swift Go 14 is part of the first volley of laptops to hit store shelves with Intel's new 14th-gen Core processors which, in this laptop, is represented by the Intel Core Ultra 7 155H. It has six performance cores, eight efficient cores, and two low-power cores.

That's a total of 16 cores and 22 threads. The maximum Turbo Boost is 4.8GHz. Acer pairs the Core Ultra 7 155H with 16GB of LPDDR5 memory and a 1TB PCIe Gen4 NVMe solid state drive.

PCMark 10 leads with a healthy score of 6,362. This is a holistic system benchmark, which means it's impacted by memory, storage, and graphics performance. That's why the Lenovo Slim Pro 9i (fave.co/46uRizJ), which has an RTX 4050, exceeds the pack. The Swift Go 14 with Intel Core Ultra 7 155h beats the model with an Intel Core i7-13700H by a couple hundred points.

Next up is Cinebench R20, a heavily multithreaded, short-duration test. Here the Swift Go 14 manages a score of 4,943, which puts the system ahead of some similarly priced laptops like the Asus Zenbook 14 OLED.
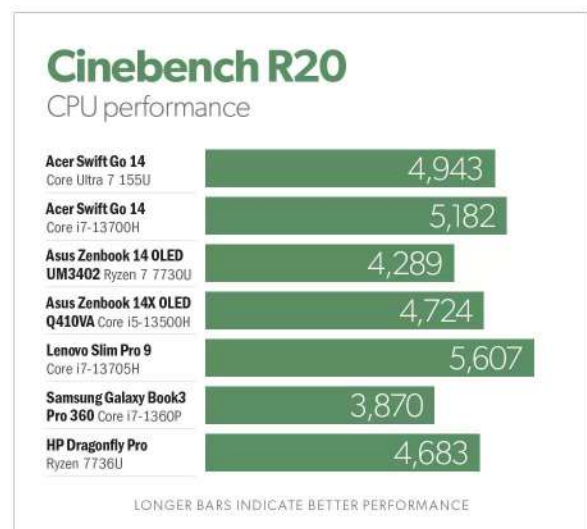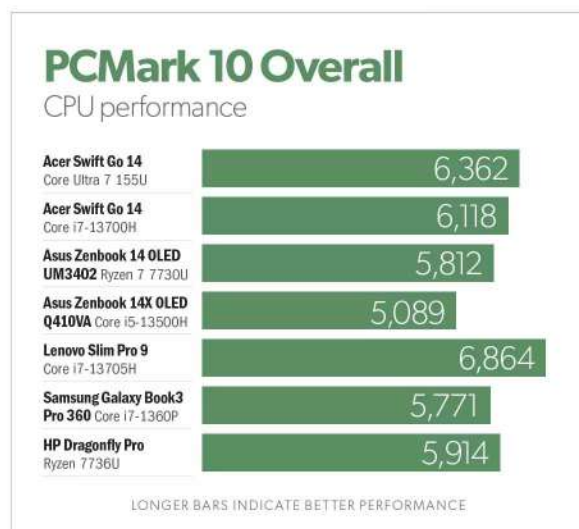
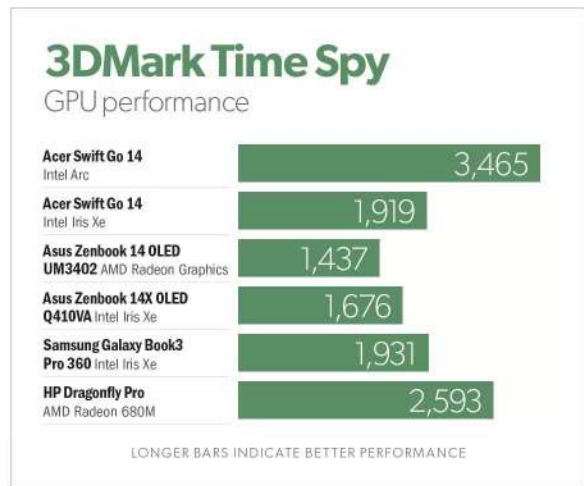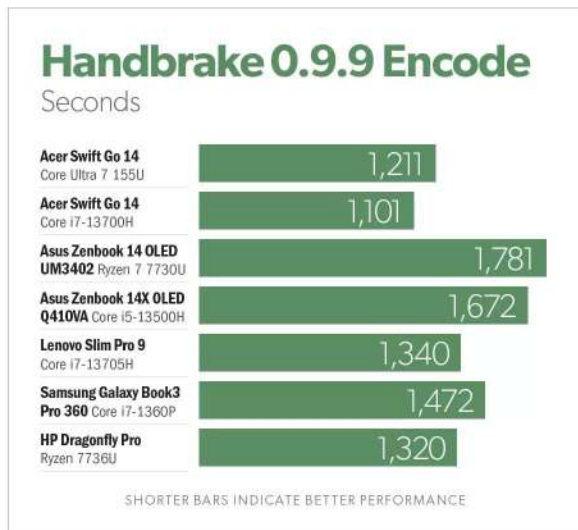I had to substitute the older Acer Swift Go 16 with the Intel Core i7-13700H in this graph,

and it lands ahead of the new Core Ultra 7 155H. That goes to show how additional thermal headroom can overcome the benefits of newer silicon. Still, the Swift Go 14's performance in this benchmark is solid for a modestly priced 14-inch machine.

Handbrake is a heavily multithread, long-duration test, and it doesn't paint the Swift Go 14 or Core Ultra 7 155H in the best light. The new laptop scores slightly behind the older machine with Intel Core i7-13700H processor.

With that said, the Swift Go 14 is the second-quickest laptop in this field of smaller, more portable laptops, which is good news for its overall performance value. You can find a faster laptop, but it's likely to be larger or more expensive.

The Intel Core Ultra 7 155H's integrated graphics solution is worth at least as much attention as its CPU core count and clock

PCMark 10 Overall
CPU performance

Laptop	Score
Acer Swift Go 14 Core Ultra 7 155U	6,362
Acer Swift Go 14 Core i7-13700H	6,118
Asus Zenbook 14 OLED UM3402 Ryzen 7 7730U	5,812
Asus Zenbook 14X OLED Q410VA Core i5-13500H	5,089
Lenovo Slim Pro 9 Core i7-13705H	6,864
Samsung Galaxy Book3 Pro 360 Core i7-1360P	5,771
HP Dragonfly Pro Ryzen 7736U	5,914

LONGER BARS INDICATE BETTER PERFORMANCE

Cinebench R20
CPU performance

Laptop	Score
Acer Swift Go 14 Core Ultra 7 155U	4,943
Acer Swift Go 14 Core i7-13700H	5,182
Asus Zenbook 14 OLED UM3402 Ryzen 7 7730U	4,289
Asus Zenbook 14X OLED Q410VA Core i5-13500H	4,724
Lenovo Slim Pro 9 Core i7-13705H	5,607
Samsung Galaxy Book3 Pro 360 Core i7-1360P	3,870
HP Dragonfly Pro Ryzen 7736U	4,683

LONGER BARS INDICATE BETTER PERFORMANCE

Handbrake 0.9.9 Encode
Seconds

Acer Swift Go 14 Core Ultra 7 155U	1,211
Acer Swift Go 14 Core i7-13700H	1,101
Asus Zenbook 14 OLED UM3402 Ryzen 7 7730U	1,781
Asus Zenbook 14X OLED Q410VA Core i5-13500H	1,672
Lenovo Slim Pro 9 Core i7-13705H	1,340
Samsung Galaxy Book3 Pro 360 Core i7-1360P	1,472
HP Dragonfly Pro Ryzen 7736U	1,320

SHORTER BARS INDICATE BETTER PERFORMANCE

3DMark Time Spy
GPU performance

Acer Swift Go 14 Intel Arc	3,465
Acer Swift Go 14 Intel Iris Xe	1,919
Asus Zenbook 14 OLED UM3402 AMD Radeon Graphics	1,437
Asus Zenbook 14X OLED Q410VA Intel Iris Xe	1,676
Samsung Galaxy Book3 Pro 360 Intel Iris Xe	1,931
HP Dragonfly Pro AMD Radeon 680M	2,593

LONGER BARS INDICATE BETTER PERFORMANCE

speeds. It ditches the older Intel Iris Xe hardware for an Intel Arc integrated graphics solution with 128 execution units (up from 96 in Iris Xe's top 13th-gen Core configuration).

3DMark Time Spy makes the improvement plain. Acer's Swift Go 14 was propelled to a score of 3,465, a result that beats the old Swift Go 14 with Intel Xe graphics by roughly 1,500 points. In fact, it's just 500 points behind some laptops with Nvidia's RTX 3050.

Gamers shouldn't get too excited, though. Arc integrated graphics delivered less impressive results in *Shadow of the Tomb Raider*, which averaged 33 frames per second at 1080p and low detail. *Cyberpunk 2077*, meanwhile, achieved an average of 41 FPS at 720p and the Low detail preset. Most 3D games are playable on the Acer Swift Go 14, but demanding titles require significant cuts to texture quality and, in some cases, resolution.

So what's the verdict on Intel's Core Ultra 7 155H (and the Swift Go 14)? It's good, especially for a laptop in this price range, but it doesn't fundamentally change what you can expect from a portable midrange laptop. Home office productivity isn't a problem, content creation is possible, and older 3D games should run without issue (as long as Arc's drivers [fave.co/3tSVEmf] don't trip you up). But those looking to handle heavier tasks like 4K video editing or AAA games, will need to buy a more expensive, more capable machine.

BATTERY LIFE
The new Acer Swift Go 14 with Intel Core Ultra 155H has the same 65-watt hour battery found in the prior Swift Go 14 with a Core i7-13700H processor. That provides a great opportunity to directly compare the battery life of Intel's new silicon.

Battery Life
Minutes

Laptop	Minutes
Acer Swift Go 14 Core Ultra 7 155U	546
Acer Swift Go 14 Core i7-13700H	520
Asus Zenbook 14 OLED UM3402 Ryzen 7 7730U	920
Asus Zenbook 14X OLED Q410VA Core i5-13500H	632
Lenovo Slim Pro 9 Core i7-13705H	467
Samsung Galaxy Book3 Pro 360 Core i7-1360P	598
HP Dragonfly Pro Ryzen 7736U	811

LONGER BARS INDICATE BETTER PERFORMANCE
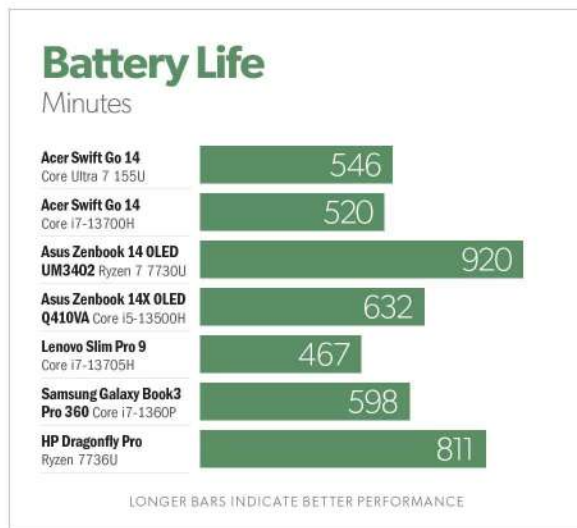
There's good news and bad news. Intel's Core 7 Ultra 155H does seem to be more efficient, as the new Swift Go 14 endures our battery test (which loops a 4K file of the short film *Tears of Steel*) for nearly a half-hour longer than the older model with Core i7-13700H processor. It's still not a great result, though, and falls behind other laptops. The Swift Go 14 can endure a full eight-hour workday, but only in less demanding workloads. Those who run demanding applications will need to keep a close eye on battery life gauge.

The Swift Go 14 ships with a 100-watt USB-C power brick that's a bit larger than the 95-watt or 65-watt power bricks found alongside alternatives like the Dell XPS 13 and Asus Vivobook 14X OLED. I was curious about what this meant for Core Ultra 7 155H's power draw, so I hooked it up to a Kill-A-Watt meter and observed power draw while running Cinebench R20. I found the laptop initially consumed roughly 90 watts of power before dropping back to about 52 watts.

BOTTOM LINE

The Acer Swift Go 14 with Intel Core Ultra 7 155H is a competent and well-rounded laptop sold at an affordable price. Its dull design is made up for with strong connectivity, a pleasant keyboard, and useful extras like a 1440p webcam. Intel's 14th-gen processor doesn't greatly outperform the 13th-gen hardware but remains strong in multicore tests and comes paired with improved integrated graphics, though battery life remains a problem. The Go 14's overall performance, alongside a price cut from Acer, makes it a good choice for those looking to buy a portable yet speedy laptop at a sub-$1,000 price.

Acer Swift Go 14

★★★⯪☆

PROS
- Good CPU and integrated graphics for its size and price.
- Pleasant keyboard.
- Crisp 1440p webcam.

CONS
- Boost over prior Intel generation is modest.
- 1920×1200 IPS display should be skipped.
- Battery life fails to impress.

BOTTOM LINE
Intel's Core Ultra 7 155H doesn't drastically upgrade the Swift Go 14 over its prior incarnation, but it remains a competent midrange machine.

$999

Alienware AW3225QF: The 4K OLED you've been waiting for

4K OLED that's cheap enough for the masses—almost. **BY MATTHEW S. SMITH**

Those looking to buy an OLED monitor were treated to dozens of new options throughout 2023, but some particular sizes and resolutions remained rare—including 4K, 32-inch OLED monitors. Though not entirely unavailable, most such monitors were extremely expensive. The Alienware AW3225QF takes a step toward lowering the price, providing a 4K, 240Hz QD-OLED panel for $1,199.

SPECS AND FEATURES

The Alienware AW3225QF is a rather unusual monitor, and not just because of its 32-inch 4K QD-OLED panel. It's also a curved display and

provides a 240Hz refresh rate (the latter wasn't available in prior 4K OLED panels but will be available from multiple companies in 2024).

Display size: 32-inch widescreen

Native resolution: 3840×2160

Panel type: QD-OLED

Refresh rate: 240Hz

Adaptive sync: Nvidia G-Sync, VESA AdaptiveSync 240

HDR: VESA DisplayHDR True Black 400, Dolby Vision

Ports: 1× DisplayPort 1.4, 1× HDMI 2.1 with eARC, 1× HDMI 2.1, 1× USB 3.2 Gen 1 Type-B upstream, 3× USB 3.2 Gen 2 Type-A downstream, 1× USB 3.2 Gen 1 Type-C downstream with BC 1.2 power charging

VESA mount: 100×100mm

Speakers: None

Price: $1,199

There's more around back, where the AW3225QF's connectivity differs from most

The black-and-white color scheme has a touch of class not found with most alternatives.

monitors. It has one HDMI port with eARC support. The AW3225QF also supports Dolby Vision HDR, which is fairly common among HDR televisions but unusual for an HDR monitor. Alienware seems to expect some owners will use the AW3225QF more like a small TV than a desktop monitor.

DESIGN

I received the Alienware AW3225QF in an attractive white-and-black colorway similar to that of past Alienware displays. It's a familiar but alluring look that uses varying materials, textures, and colors to craft a more luxurious and upscale feel.

It's still clad in plastic, like nearly all modern monitors and televisions, but the AW3225QF definitely has a touch of class not found with most alternatives. Samsung's recently revised Odyssey monitors are the only competitors I find equally attractive.

The AW3225QF is a curved monitor with a modest but noticeable 1700R curve. I'm not a fan of this decision, as I don't find 32-inch widescreen monitors wide enough for the curve to add to my immersion. Those who don't like a curve could instead consider the 4K 32-inch Odyssey OLED G8 (fave. co/47KyD32).

Alienware ships the monitor with a huge, overbuilt stand that adjusts for height, tilt, and swivel. It keeps the

Alienware ships the monitor with a huge, overbuilt stand that adjusts for height, tilt, and swivel.

AW3225QF firmly planted (you'd have to go at it with a baseball bat to knock it over), but the stand's wide, wing-shaped design takes up a lot of desk space. It's also deep, which means the monitor may sit uncomfortably close if your desk is narrow. A smaller stand would be a better choice for the display.

That problem can be avoided with the 100×100mm VESA mount, which makes the monitor compatible with third-party monitor arms and stands.

CONNECTIVITY AND MENU

The Alienware AW3225QF's video connectivity is unusual for a computer monitor. It has a DisplayPort 1.4 port, which is typical, but it pairs that with two feature-packed HDMI ports.

Both ports are HDMI 2.1, and both support the monitor's native resolution of 3840×2160 at its maximum refresh rate of 240Hz. They also support FRL and VRR as specified in HDMI 2.1, so they're broadly compatible with enhanced refresh rates and variable refresh rate/adaptive sync signals delivered from a PC or a game console.

One of the two ports also supports eARC, which is uncommon for a monitor. ARC stands for Audio Return Channel. It should let users connect a soundbar or other audio device via HDMI to the monitor, which can then be used alongside any video input. The eARC port also supports Dolby Atmos sound.

With that said, I found the eARC feature didn't work with my Yamaha YAS-207 soundbar (which supports DTS:X instead of Dolby Atmos). It's possible that a setting prevented this, as Dell did not have a finalized user manual available at the time I was writing this review.

The AW3225QF also has USB connectivity, though it's a rather tame set of options. It has three USB-A ports and one USB-C port. The USB-C port includes power charging, but only delivers enough power to charge a smartphone at an acceptable speed. Video isn't supported over USB-C, either. All of the USB ports are driven by a USB-B upstream port, which means that the USB connectivity is best

Alienware AW3225QF's connectivity features.

suited to work alongside a desktop PC or a large laptop.

Alienware's menu system is controlled by a joystick centered on the monitor's chin. It responds quickly to user input, and the menus are easy to navigate. A fair range of options is available, including multiple SDR and HDR modes and a custom color mode that allows for color calibration. Color temperature adjustment is supported, but only through Warm and Cool presets. I also found a gamma setting was available only when Console Mode or Creator Mode was enabled. That's confusing, and Alienware would do well to place a broad range of color temperature and gamma controls in one location so they are easier to find and use.

There are also a few gamer-centric features, such as a black equalizer, which increases the brightness of dark areas of the display, and an on-screen crosshair. These features are standard for any modern gaming monitor, but they are still much appreciated.

The AW3225QF doesn't include speakers. It also lacks an audio line-out jack, so it's not possible to pass audio to a 3.5mm headset or similar desktop speakers. Alienware says it dropped the audio line-out connection because most modern headsets or speakers use USB or have gone the wireless route.

SDR IMAGE QUALITY

The Alienware AW3225QF is a 4K OLED monitor, so image quality expectations are high—and they're delivered. It's a top-notch monitor for SDR content that suffers just one small flaw common to many OLED displays.

The flaw? Brightness. The AW3225QF has a maximum SDR brightness of 240 nits, which

Maximum SDR Brightness
Nits

Monitor	Nits
Alienware AW3225QF	240
Corsair Xeneon 27QHD240	245
AOC Agon Pro AG276QZD	244
Inoocn 27M2V	645
Acer Predator X32 FP	460

LONGER BARS INDICATE BETTER PERFORMANCE
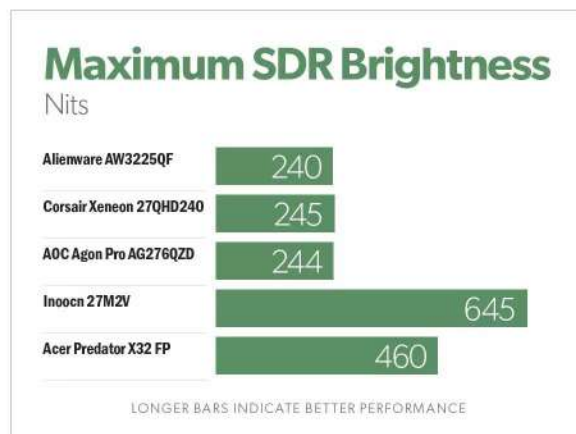
Contrast Ratio
At 50% brightness

Monitor	Contrast Ratio
Alienware AW3225QF	Infinite
Corsair Xeneon 27QHD240	Infinite
AOC Agon Pro AG276QZD	Infinite
Inoocn 27M2V	8,150:1
Acer Predator X32 FP	3,230:1
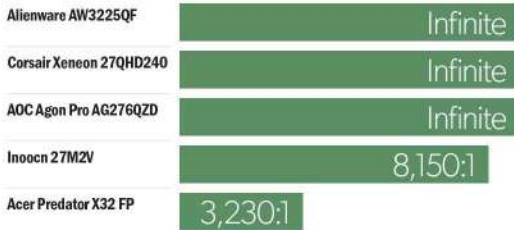
LONGER BARS INDICATE BETTER PERFORMANCE

is certainly toward the low end for a modern computer monitor. Many monitors can now exceed 400 nits, but OLED displays tend to land between 200 and 300 nits. The AW3225QF's surface is glossy, too, so glare shines through.

This isn't a problem for most people, as 240 nits remains more than adequate in a room with light control (like blinds or curtains). I typically used the monitor at just 25 percent of its maximum, especially after dark. But it could become an issue if the monitor is used in a room with large windows that lack blinds or curtains, or in a brightly lit space like an office bullpen.

Contrast, on the other hand, is a strength of all OLED displays, and the AW3225QF delivers excellent results. It provides an effectively infinite contrast ratio, as the monitor achieves a minimum luminance of zero nits. That means dark areas of the screen appear perfectly dark, and adds a sense of depth and realism to everything viewed on

the display. It's especially excellent for games with a dark presentation, like *Diablo IV* or *Resident Evil: Village*.

Shoppers should note, though, that this performance is typical across a broad range of modern OLED displays. The AW3225QF has no advantage, or disadvantage, when compared to alternatives.

The AW3225QF delivers great color gamut results, as its color gamut spans 100 percent of sRGB, 98 percent of DCI-P3, and 94 percent of AdobeRGB. These results are better than some OLED monitors from 2023, but fall a slight step behind the best Mini-LED monitors, such as the Acer Predator X32 FP (fave.co/42lfxc4). Still, the AW3225QF performs well and delivers a color gamut

Color Gamut

■ % Adobe RGB　■ % DCI-P3　■ % sRGB

Monitor	% Adobe RGB	% DCI-P3	% sRGB
Alienware AW3225QF	94	98	100
Corsair Xeneon 27QHD240	91	97	100
AOC Agon Pro AG276QZD	91	87	100
Inoocn 27M2V	99	99	100
Acer Predator X32 FP	100	96	100

LONGER BARS INDICATE BETTER PERFORMANCE

Average Color Error

Alienware AW3225QF	0.42
Corsair Xeneon 27QHD240	2.9
AOC Agon Pro AG276QZD	5.32
Inoocn 27M2V	0.91
Acer Predator X32 FP	2
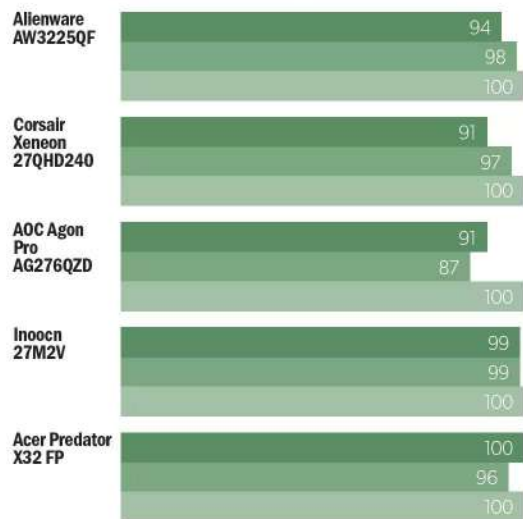
SHORTER BARS INDICATE BETTER PERFORMANCE
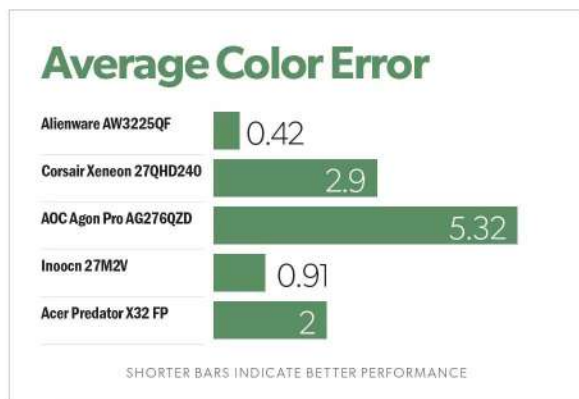
that's far more than adequate for nearly any task you'd perform on a computer.

Next up is color accuracy, and here the AW3225QF is a knockout. The average color error of 0.42 is among the best I've ever recorded, and it's achieved through consistent results across all tested colors. The AW3225QF's color presentation is lifelike and realistic overall.

The AW3225QF's image is a bit warm with a color temperature of 6200K. That's off a target of 6500K. It results in a slightly redder image that might look cozy but can also feel a bit dusty, depending on your preference. The gamma result of 2.2 is directly on target and means content will appear about as bright as it should. Both the color temperature and gamma can be adjusted, although, as explained earlier, the menu system is a bit fussy in how color temperature and gamma controls are presented.

Sharpness, which is usually a downside for OLED monitors, is good. The 3225QF's OLED panel packs 137 pixels per inch, a big upgrade over a 32-inch 1440p monitor, which has just 91 pixels per inch. 1440p OLED monitors tend to suffer in sharpness due to a sub-pixel layout that disagrees with Windows, but I found this much less noticeable on the pixel-dense 3225QF.

The Alienware AW3225QF's SDR image quality results add up to fantastic image quality. It offers a realistic image with vibrant color and a great sense of depth. Brightness is a bit low, but that's only an issue if you want to use the monitor in a brightly lit room, and the monitor's many perks make that downside easy to forget.

HDR IMAGE QUALITY

Most OLED monitors support HDR, but the AW3225QF's certifications suggest it's a cut above the rest. It has VESA DisplayHDR 400 True Black certification, but also a Peak 1000 (as in 1,000 nits) mode. And it supports Dolby Vision HDR, a feature common to HDTVs but rare on a computer monitor.

And, as it turns out, the AW3225QF's HDR performance is better than most OLED monitors I've tested. It's still dim when displaying a full-screen white HDR image, achieving just 220 nits. But that goes up to 306 nits when the image covers 50 percent of the display, and 480 nits when it covers 10 percent of the display (the image should result in at least 1,000 nits).

That's not bad. A few other OLED monitors, such as the Asus PG27AQDM (fave.

), perform better: It was brighter in both the 50 percent and 100 percent tests. But the AW3225QF's HDR results are better than both most competing OLED monitors and a tad superior to prior Alienware OLED monitors, such as the AW3423DWF.

I found the AW3423DWF a strong HDR monitor overall, and not only because of its brightness. It also has a color gamut wide enough to deliver a vivid, beautiful experience, and increasing the resolution to 4K (instead of the 1440p previously common to OLED monitors) brings big gains in sharpness when viewing a 4K source.

The end result is a more cinematic experience than what most prior OLED monitors could achieve. It instead feels close to the Asus ProArt PA32DC (), a $3,500 4K OLED display meant for the most demanding professionals. The PA32DC was even brighter in my tests, and reached a wider color gamut, but the Alienware AW3225QF's overall performance is not far off that high benchmark.

Mini-LED displays are typically better in terms of HDR brightness, and those looking to maximize the HDR experience should look toward a Mini-LED display. But the AW3225QF is no slouch, and, given its many other strengths, it's a competitive choice. That's especially true if you plan to connect an Xbox Series X alongside a PC to play console games and watch Blu-Ray movies, as the Xbox Series X supports Dolby Vision.

MOTION PERFORMANCE

The AW3225QF's 240Hz refresh rate doesn't set records (LG has announced an OLED monitor with a 480Hz refresh rate), but it provides excellent motion clarity. Fast-moving objects are easy to identify and high-resolution textures retain most of their detail when scrolling or moving the camera in a 3D game.

The Alienware AW3225QF comes with a respectable 240Hz refresh rate.

Gamers should remember that OLED panels generally achieve better motion clarity than IPS or VA panel monitors at any given refresh rate. That's true because the individual pixels of an OLED monitor respond more quickly to changes than IPS or VA. As a result, the motion clarity of the AW3225QF is more similar to a 360Hz IPS or VA panel monitor.

The AW3225QF is a fantastic 4K OLED monitor.

The monitor also supports adaptive sync to eliminate screen tearing and provide smooth frame pacing in 3D games. Its official support includes Nvidia G-Sync and VESA AdaptiveSync 240 certification. AMD FreeSync is not officially supported, but it functioned when tested with a Radeon RX 7800 video card.

BOTTOM LINE

Alienware's AW3225QF is a fantastic 4K OLED monitor. Prior OLED monitors also looked great, but the reliance on 1440p resolution was a downside for those who want the absolute best image quality available. The AW3225QF's improved sharpness is lovely and comes paired with extra features, like Dolby Vision HDR and support for 4K/240Hz across multiple video inputs. Alienware's oversize stand is an annoyance, and the curved display panel is an acquired taste, but these issues are relatively minor.

Its pricing isn't bad, either: $1,199 is expensive, but it's a big reduction compared to prior 4K OLED monitors, which often retailed for $2,000 to $3,000 (or more). ⏻

Alienware AW3225QF
★★★★☆

PROS
- Excellent color performance and contrast.
- Good overall HDR performance.
- 240Hz refresh rate with great motion clarity.

CONS
- Stand is too large.
- Curved panel is an acquired taste.
- HDR brightness is still just okay.

BOTTOM LINE
The Alienware AW3225QF is a gorgeous 4K OLED monitor ideal for both PC gaming and game consoles.

$1,199

Lenovo Legion Go: Impressive handheld PC, flawed UI

Lenovo's handheld console goes head-to-head with the Asus ROG Ally. **BY MATTIAS INGHE**

After the Nintendo Switch proved that users wanted to be able to take their gaming with them on more than just their mobile phones, handheld gaming devices got a new lease on life. This was largely thanks to a focus on power-efficient but game-friendly x86-based mobile processors from AMD.

The Steam Deck was first. It was well built and optimized, but Linux based and limited to select games in Steam's own store. But it didn't take long for other manufacturers to catch fire and start looking at handheld gaming PCs.

Asus released its Windows device, the ROG Ally (fave.co/47TONb2), and now the Lenovo Legion Go is another competitor in the space. It is built on the same processor, the AMD Ryzen Z1 Extreme; it has the same amount of memory and storage, 16GB RAM and 512GB SSD; and it more or less matches the ROG Ally in performance.

The AMD circuitry with Zen 4 architecture and RDNA 3 generation provides impressive graphics performance on PC titles, and I get the same passable frame rate and quality as I did when I tested the ROG Ally. I can run games like Starfield and Cyberpunk on medium graphics settings, between 30 and 60 FPS. These are low numbers for any performance-oriented gaming PC builder, but most of us may not want to pay as much for

Starfield in Xbox Series S quality, more or less. It's impressive on a Windows PC without a separate graphics card.

LARGE AND BOLD DISPLAY

You could be forgiven for thinking that Lenovo had seen the ROG Ally and then crammed all the upgrades and solutions it could think of to not only build on Asus's computer, but solve gaps where it was lacking. That's not what happened, of course—they've been developing in parallel. But since the Legion Go was released a few months later, it feels like a direct response to the Ally.

The screen is larger—8.8 inches versus 7 inches—and has a higher peak frequency (144Hz versus 120), and higher resolution (2,560×1,600 pixels where the ROG Ally has 1,920×1,080 pixels). It's also a colorful display, with a gamut close to the dci-p3 standard and a high brightness of up to 500

just the graphics card as we're paying for an entire handheld PC.

Many games require much less performance and run even better at 60 FPS or more, some going all the way up to the screen's maximum frequency of 144Hz. One downside is that the Legion Go doesn't support Freesync. Lenovo claims that it shouldn't be necessary with a screen as fast as this one, with a frame rate of 144Hz, but I seem to see a hint of screen tearing in some situations anyway. When I run the screen in 60Hz frequency mode and limit it to 60Hz, the issue becomes more noticeable. But is this a big problem? Not really—you shouldn't expect perfection in such an affordable device.

Screen resolution and frequency are easy to control.

cd/m2. Even though black surfaces leak some background light at full brightness, it provides crisp contrast, especially if I dim the brightness to half, which is not a problem indoors.

The display is very sharp and beautiful to look at, and as long as AMD's hardware keeps up, you get an exceptionally good flow. The display means it's also great for nongaming tasks, like watching videos. Plus, the larger surface area also provides better immersion in games. Should the full resolution be too much for the hardware to handle in heavy games, it's easy to lower it to either 1,280×800 or 1,920×1200.

CONTROLS LIKE A SWITCH

The Lenovo Legion Go settings menu slides in from the side of the screen with the press of a special button. Here you can also control frame rate and set other basic things for the device, such as sound volume, screen brightness, RGB light effects in the controls, and simple performance and fan control. You also get a quick check on battery levels for your computer and controls.

The controls are detachable (as on a Nintendo Switch) and communicate wirelessly with the centerpiece. This means you don't have to hold up the entire Legion Go, which weighs almost 9 kilograms.

Detachable controls.

Instead, you can place it on a table and sit with half a controller in each hand. Unfortunately, there doesn't seem to be a central holder to attach them to, as there is for the Switch. Lenovo will have to work on that.

The controls, whether in place or loose, are functional and feel well built. There's the usual combination of two d-pad control sticks, trigger buttons on the top, control crosses, and action buttons. They are all reasonably easy to reach and have good mechanical feedback. If I had one complaint, it is that a couple of the buttons on the top have a slightly oversensitive trigger, so I need to learn not to rest my fingers on them.

In addition to these, there are also two more buttons on each backside that can be manually mapped to optional functions in your games. Honestly, I avoid

One of them has both a built-in mouse pad and an optical mouse at the bottom.

them—they're so easily accessible on the back that I'm constantly pressing them by accident.

TWO TYPES OF MOUSE!

One thing that the Legion Go boasts over the ROG Ally is mouse control. This is valuable for many nongaming tasks, and for extra control and precision in certain games. ROG Ally solved that with an alternative mouse pointer mode for one of the d-pad sticks, but it's a poor substitute for a true traditional mouse.

That's what you get in the Legion Go—partly with a mouse pad on the front of one of the controls, and partly with what Lenovo calls FPS Mode. The right control has an optical mouse sensor at the bottom, and a switch that activates that

mode. It then becomes a regular wireless mouse, and can be placed in a special support and dragged across the table. On the side of the control are mouse buttons that work as normal right and left clicks, and you also have a scroll wheel with a center button press.

It sounds good in theory, but in reality it's not easy to use. The mouse is uncomfortable to grip with angular shapes, strange button placement, and a joystick that uncomfortably pokes my palm.

THE SAME OLD GAMING PC BEAST

With the right half as a mouse, I lose all other button controls on that side, and games think I've also connected a keyboard, so I have to painstakingly map the remaining buttons and

Behind the proprietary menu interface hides ordinary Windows 11.

controls to correspond to keyboard buttons, except for a few that are pre-configured.

That's assuming the game you want to run has good support for it, which not all do. And even those that do don't always make it easy. For example, I tested the Legion Go in Starfield and discovered after half an hour of button reprogramming that I had run out of available things to press and still forgotten the jump button.

Steady support on the back—I appreciate that.

In addition, on a couple of occasions, I found that loose controls lost contact with the main unit, so sometimes I had to interrupt a game session, reconnect, and even restart the whole Legion Go for everything to start working properly again. Another problem with FPS Mode is that the left d-pad starts feeding WASD commands to the system. It works inside games, except that you don't get the right analog control there, but it is very impractical in all other modes.

Mouse control is a good idea, but Lenovo needs to fine-tune the implementation before it's worth using. It is much easier to simply connect a mouse and keyboard and play that way instead. It seems to work quite stably.

ALMOST COMPLETE AS A DOCKED COMPUTER

The easiest way to connect devices is via Bluetooth, but if you're like me, you may want to be able to use Legion Go as your full PC. A good computer is a good computer, and it would be a shame not to make full use of it. I recommend investing in a USB-C dock or a monitor with all that built in.

You have two USB-Cs, one on the top and one on the bottom. Both with the same USB 4 speed, power supply support and display port output. With a good docking station, it's easy to plug in the screen, power and wired accessories. Then you minimize or close Lenovo's Legion Space program to get a normal Windows desktop instead.

The only thing missing for full PC functionality is a webcam. I'm just as disappointed in this as in the ROG Ally. Surely they could have offered a simple one—after all, the cheapest laptop or tablet has it. But even that can be docked and hung on your desktop.

ALL GAMES IN ONE PLACE

Legion Space is an application that starts automatically when you launch the Legion

Go, and provides a console-like interface to keep track of and launch installed games. They can come from most major PC game stores like Steam, Xbox, Epic Games, and GOG. Lenovo also has its own

Lenovo's Legion Space Go contains a lot, and it's easy to get lost among the tabs, sections, and menus.

game store built into the Legion Space, and you can freely add any other installed games or programs to your library.

If you have Xbox Game Pass Ultimate, a menu for its streaming game library is also integrated, and you get a three-month trial subscription to it as well. Finally, there's a tab for Android games too, but it's currently inactive with a "Coming Soon" message, so what will appear there in the future remains to be seen.

It's the same confusing misery of jumping between different game stores and different interfaces to buy games, install them, and get them neatly into the library menu in Legion Space, so that you can then neatly and smoothly launch them. It may also require separate launchers and add-ons to start, requiring their own logins and popping up with messages and requirements for security

codes, account linking, cloud seeding of save files, and much more.

This is nothing a Windows gamer isn't already frustratingly aware of, but it adds an extra layer of clutter and annoyance to trying to manage in handheld console format on a cramped little screen. Then the mouse pad actually helps some, but far from enough. That's another reason to dock the Legion Go—then you can configure everything the way you want it first, and even fine-tune individual games and go back to handheld console mode.

BOTTOM LINE

The Lenovo Legion Go starts from $699. It's available from Lenovo (fave.co/3S2Svly), Walmart (fave.co/422hUqn) and Best Buy (fave.co/4b08qzY). Like the ROG Ally, the Legion Go has an impressive build and it's

remarkable that it costs as little as it does. It's a full-fledged mini PC with the capacity for both productivity and budget gaming that you can also play on while lying on the couch, or for gaming sessions on the go. That said, these are short sessions, as the battery won't last more than a couple of hours.

Lenovo raises the bar a bit from what the ROG Ally delivers, with a better screen and very versatile controls, but that leads to frustration and headaches as much as opportunities. A lot of user feedback and interface updates are needed before it's perfected, and I think Lenovo could have done more of that internally first before releasing this console. Not all of the hardware is top-notch, either—I'm not impressed with the relatively weak sound, for example.

Finally, I am once again asking computer manufacturers and AMD to go all-in on the Ryzen Z1 Extreme, and release more compact computers with this brilliant processor—not necessarily handheld consoles, but small gaming laptops at a good price that could really stir the pot.

SPECS

Product Name: Lenovo Legion Go 83E1000KMX

Tested: November 2023

Manufacturer: Lenovo

Processor: AMD Ryzen Z1 Extreme, 8 pcs Zen 4 cores up to 5.1 GHz

Graphics: AMD Radeon Graphics 12CU, 2.7 GHz

Memory: 16GB lpddr5

Storage: 512GB ssd, micro sd slot

Display: 8.8 inch glossy ips, 2560×1600 pixels, 144 Hz, multitouch

Webcam: No

Connections: 2 pcs USB-C 4 with display port, 3.5 mm headset

Wireless: Wi-Fi 6e, Bluetooth 5.2

Operating system: Windows 11 Home

Other: Removable gamepad controls, optical mouse, mouse pad, fold-out stand, carrying case

Noise level: 0–37 dBa

Battery life: 40 Wh, about 1 hour 20-minute game (full brightness), about 7 hours, 30 minutes passive (low brightness)

Size: 29.9×13.1×2-4.1 cm

Weight: 865 grams ⏻

Lenovo Legion Go
★★★★☆

PROS
- Impressive performance.
- Clear and sharp display.
- Versatile.

CONS
- Large and heavy.
- Several minor issues with interface and features.
- Unimpressive sound.

BOTTOM LINE
The Lenovo Legion Go has an excellent display, a steady kickstand and feature-rich, versatile controls. However, it has a confusing and cluttered platform. If you can look past that, it's brilliant for gaming and even more.

$699
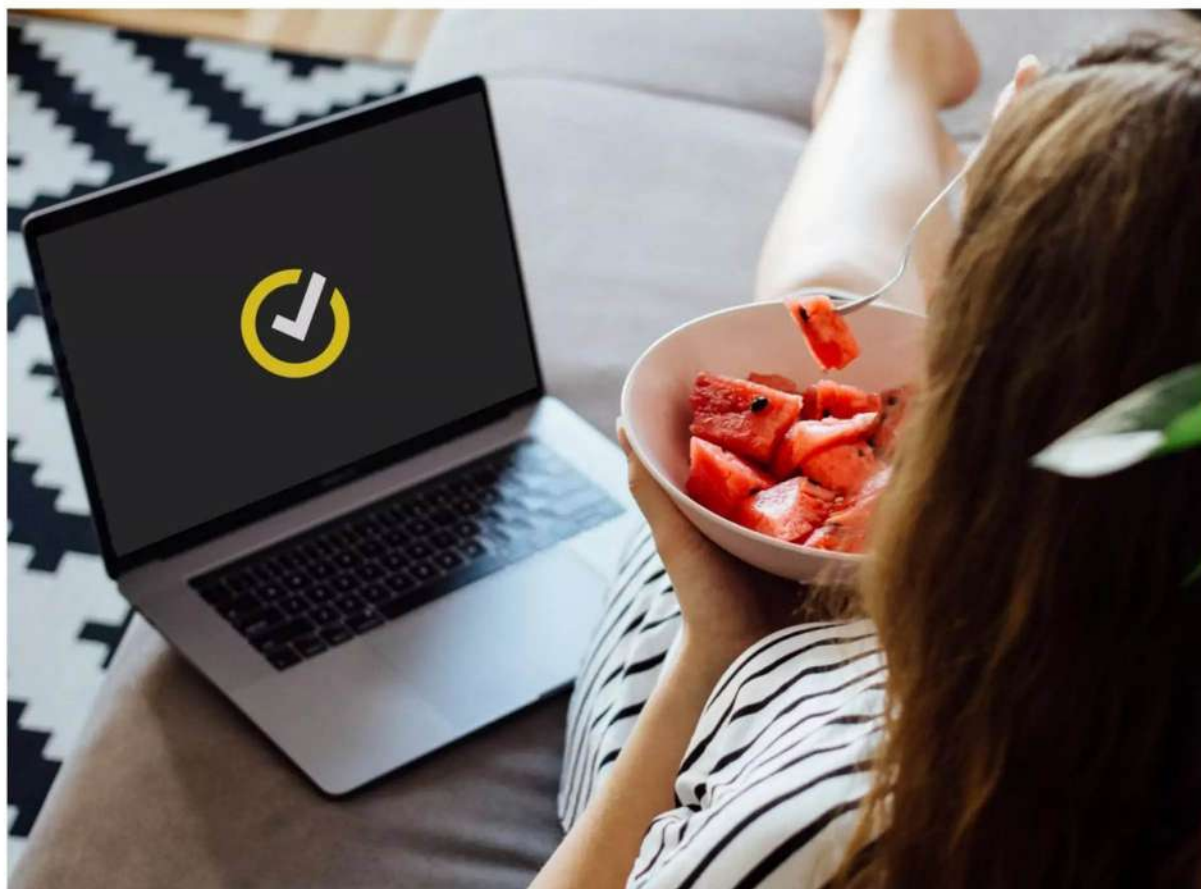
Norton 360 Deluxe: Excellent value and strong protection

Norton 360 Deluxe is a great product overall, but midrange and budget PCs can see a dip in performance. **BY ALAINA YEE**

Of Norton's offerings, the Norton 360 Deluxe plan hits an ideal sweet spot of wide protection and affordable pricing. It's an excellent all-in-one solution for those who would otherwise be more lax about security if they had to maintain each

piece separately. For example, if you're more likely to use a password manager if it's part of same user interface as your antivirus, then this is a good solution for you.

Not much is outwardly different since we last reviewed Norton 360 Deluxe, though the company continues to work on and evolve its

back end. Arguably, that's the more important focus, especially as AI enables bad actors to be more and more sophisticated about their malicious behavior.

What has changed is that other rival antivirus companies have joined with Norton under a single owner. Parent company Gen Digital now owns Avast, AVG, and Avira in addition to Norton, and during a press briefing, Gen shared plans to power all its antivirus software with a single engine and focus more on the features offered by each of its brands.

That's welcome news, because Norton 360 Deluxe's main Achilles heel isn't its performance, but rather how it presents its features to users. And that's a drag on an otherwise excellent product.

WHAT DOES NORTON 360 DELUXE INCLUDE?

Norton groups its many plans under two main umbrellas: Antivirus and All-in-One, with notable overlap in features. Though access to more online protections is always good, keeping the options straight can get a little overwhelming.

Norton 360 Deluxe stands out among the bunch as an all-in-one plan that protects
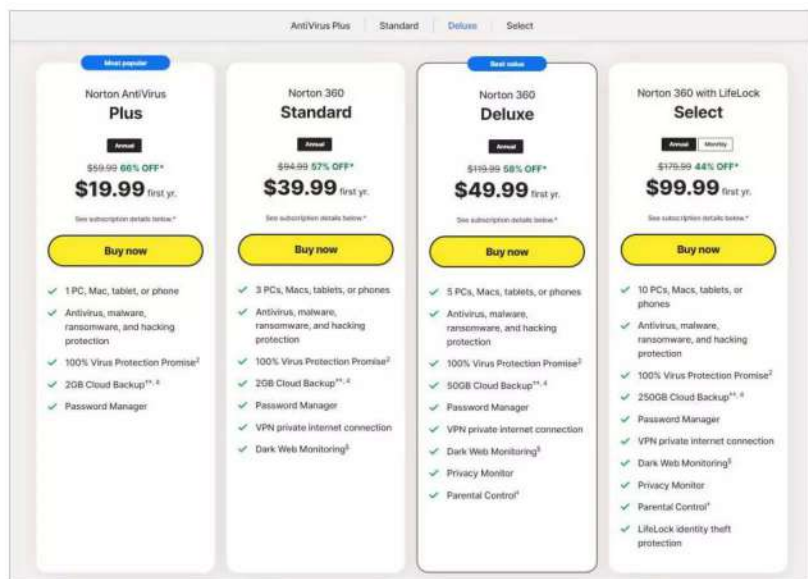
Norton 360 Deluxe offers a wide range of features for its price.

against major online threats, without including extras you may not need, like identity theft assistance. Protections against online threats include antivirus, malware, and ransomware detection, a built-in firewall, malicious link and attachment screening, dark web and privacy monitoring, and webcam safeguards. You also get 50GB of storage for cloud backups, access to Norton's password manager and VPN, parental controls, and PC utilities that include the ability to monitor for outdated software.

Some features, like the privacy monitoring, can be upgraded to include help with scrubbing you from data broker sites. And Norton lets you know it, too. Despite already having paid for a plan, you won't be immune from upsells of additional subscription services.

PRICE

When purchased through Norton directly, the Norton 360 Deluxe plan costs $50 for the first year, and then reverts to a higher full price of $120 afterward. Plans come with a 60-day money-back guarantee (fave.co/41YIzEK). Be aware that Norton automatically enrolls you into auto-renewal at sign-up.

- $50 for the first year
- $120 per year thereafter

You can use Norton 360 Deluxe as an individual or family plan—Norton only limits use by number of devices, which you can spread across Windows, macOS, Android, and iOS as you choose.

Compared to rivals, Norton doesn't favor number of devices over features (or vice versa). Instead, you get a good balance between the two on this mid-tier all-in-one plan. If you really need more devices, you can upgrade to Norton 360 Premium (fave.co/3HmQZMu), which isn't widely advertised on the website. Costing only a little bit more ($55 for the first year and $140 for every year thereafter), it doubles the number of protected devices to 10 and cloud storage to 100GB.

As with other antivirus suites, you can save further on Norton 360 Deluxe (and Premium) through third-party retailers, including PCWorld's own digital store (fave.co/4aUsS5n), Amazon, and Newegg. These plans vary more in number of devices and length of subscription, which can help you get a better deal for your situation. That's especially so during major deal periods like Black Friday—just this past year, we saw a one-year subscription drop to just $20 for Deluxe (fave.co/3Hqq42g), and to $25 for Premium.

KEY FEATURES OF NORTON 360 DELUXE

Installation and user interface

To get Norton 360 Deluxe on your PC, first purchase a subscription and then download the installation file.

When that's complete, you'll first see the My Norton interface—which is only one of the two you'll interact with. It has a modern, streamlined look, and Norton 360 Deluxe's major features can be accessed through it—scans, updates for the program, the VPN, the password manager, dark web and privacy monitoring reports,
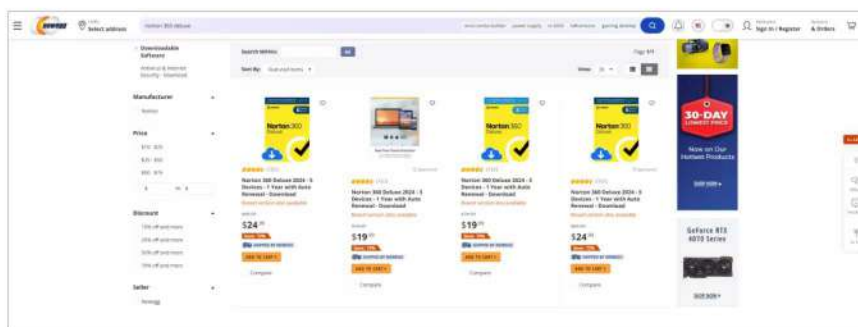
You can buy a license for Norton 360 Deluxe through online retailers.

cloud backup, and parental controls. You can also jump straight to the secure browser and software updater, as well as settings, notifications, and help files. In a nice touch, your subscription status (that is, days remaining) is listed in the upper-left corner.

For the most part, this view is simple and clear, but it does have some quirks. One is the lack of a back button while navigating through submenus (like in settings). Another is the limited settings.

To access deeper settings, you'll need to switch to the Classic view. It lets you customize the behavior of antivirus scans, the firewall, backups, and protections for email, apps, and your webcam. You can also tweak administrative settings for the Norton app, like whether remote management or silent mode are enabled.

You can hop over to Classic view by choosing Device Security > Open in the My Norton view. This interface has a more dated vibe, with four tiles that let you access features (Security, Internet Security, Backup,
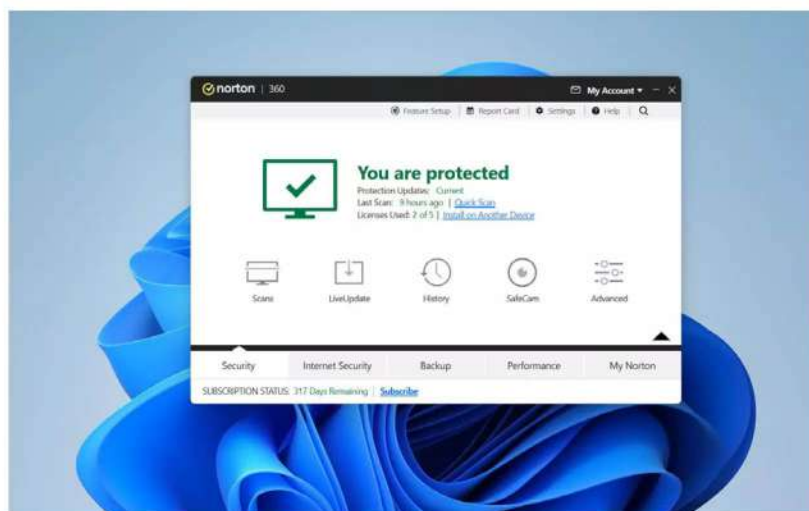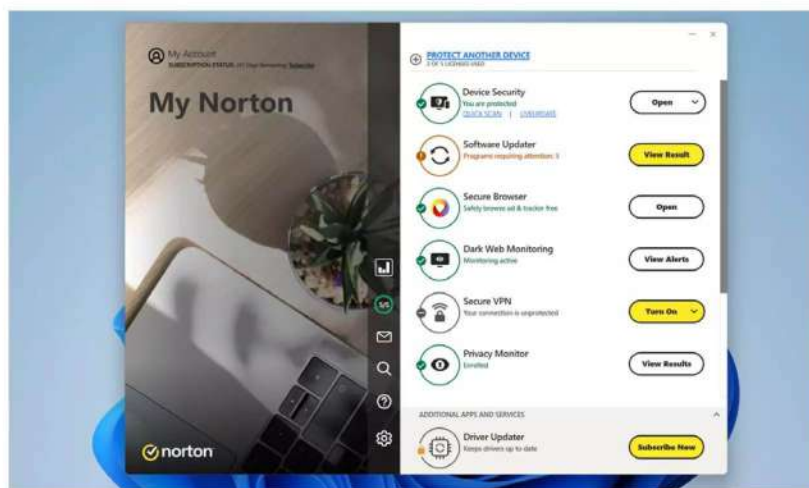
Norton 360 Deluxe's interface has two different views, and you have to bounce between both to get access to all features.

and Performance). Tap on any of them, and the full options reveal themselves in the middle of the screen. A fifth tile is dedicated to switching back to the My Norton view.

Several features can only be accessed through the Classic view: for instance, the webcam protection settings and the password generator.
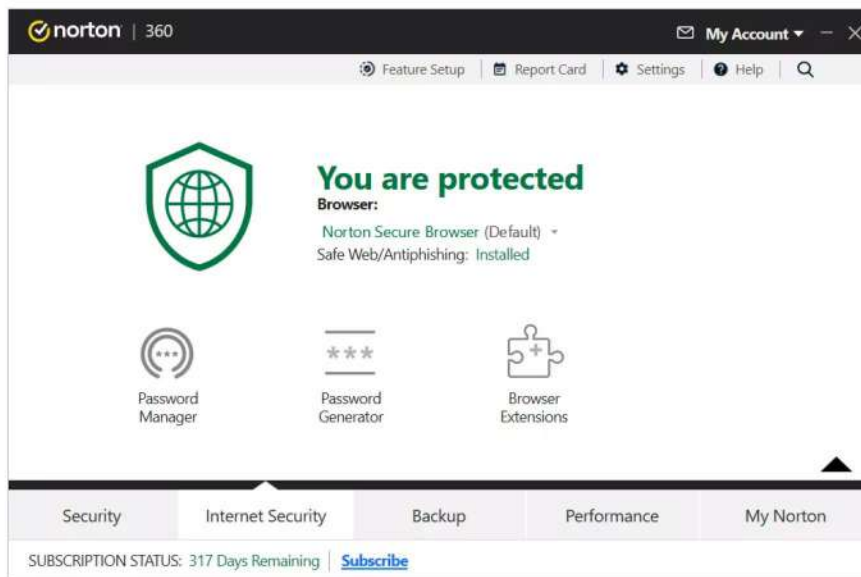
The Password Generator tool is only available through the Classic view.

With this dual interface setup, your best bet to not get too lost is to click around and get familiar with each layout. One tip for data nerds: You can look at reports about your usage and scan outcomes over time.

As for notifications, Norton does err on the side of more pop-up notifications about status changes and activity, but you can turn them off pretty easily. That's unfortunately not the case for the promotion of additional paid services.

Virus, malware, and threat protection

Real-time protection

Norton 360 Deluxe protects your PC from real-time threats in several different ways. It scans new or altered files that you've added, opened, or downloaded; controls access to files and folders that could be targeted by

ransomware; and monitors apps for unusual activity. USB drives are also scanned by default as well, as are network drives and scripts in Microsoft and Adobe documents. Norton 360 Deluxe also strips away scripts when downloading documents. And email on your PC is checked for sketchy links and malicious attachments, both incoming and outgoing.

When you're on the web, 360 Deluxe will check websites to see if they're secure and if they've been compromised—but only if you have the Norton Safe Web extension installed. Norton 360 Deluxe also limits access to your webcam (SafeCam).

Scheduled and manual scans

Norton 360 Deluxe's default schedule is a monthly full scan—but you can change its frequency with surprising precision. (Want to run it every 15 hours? Not a problem.) You can also set a schedule for the other default scan types: Quick Scan, Drive Scan, Folder Scan, and File Scan, or create your own custom scan to add to the list.

Advanced users may find the settings for each scan limited. The full scan, for
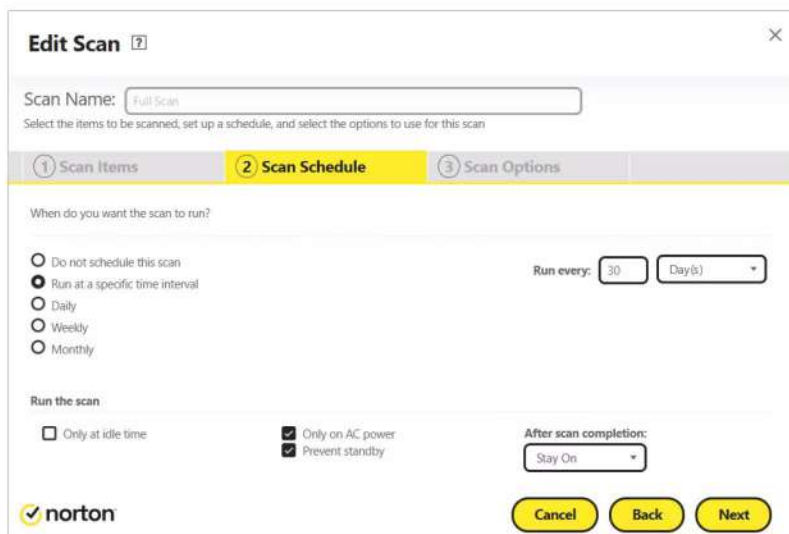
You can edit the settings for scans to change their location and how often they happen.

Additional features
Browser extensions

For comprehensive protection, Norton provides several browser extensions to improve online safety. The ones related to web safety are Norton Home Page (which changes your default to Norton's rendition of a start page), Norton Safe Search (which changes your default to Norton's search engine), and Norton Safe Web (which scans links and adds a green or red badge to let you know if they're safe or not to visit).

example, only lets you choose to scan within compressed files, remove infected folders automatically, scan network drives, and delete low-risk and tracking cookie files. The other default scans have even fewer settings, and there's no option to run a complete and exhaustive deep scan. This saves on system resources—and won't hit your PC as hard, if you don't change your file collection much after the software does an initial pass of all your files—but if you like to manually run thorough scans, you'll be disappointed.

Not all of these are universally helpful, though—most people who already have a preferred home page and search engine will only find value in Norton Safe Web. And weirdly, installing only Norton Safe Web is
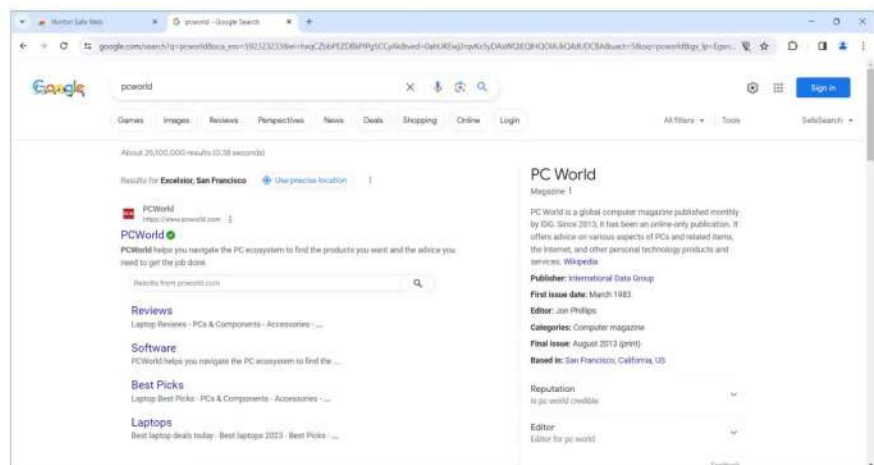
The Norton Safe Web browser extension screens links in search results.

circuitous on Chrome. I could only get it onto my test PC by going through the Norton 360 Deluxe app, which forces you to first install Norton Home Page and Norton Safe Search.

Fortunately, since I went through all that, you can use this direct link for Norton Safe Web (fave.co/3u497aV) to the Chrome Web Store. Why the extension doesn't turn up when running a search for it isn't clear.

Separately, you can install Norton Password Manager, as well as Norton Family (which monitors web browsing habits). The password manager is the most polished (and in my opinion most useful) of all available extensions. At most, you'll really only want to use Norton Password Manager, Norton Safe Web, and possibly Norton Family.

Cloud backup

To have Norton back up your most important files, you'll need to first set up this feature within the app. If you accept the default settings, cloud backups will upload everything except video and email files in your Windows document folders (that is, Pictures, Documents, Music, and so forth).
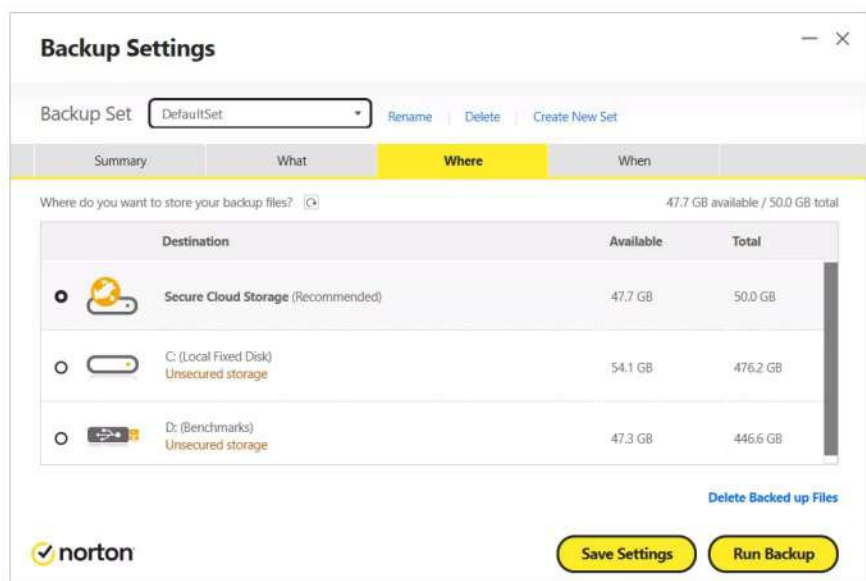
Attempting to back up to a local drive did not work when I tested the feature on more than one PC.

You can change the file types, as well as add or exclude files and folders. You can set up different backup rules (creating what's called a Backup Set), but you can only save to one location per backup set.

Speaking of saving location, this feature really only seems to be for cloud backups. If you choose a local location, Norton 360 Deluxe doesn't seem to work properly. On more than one PC, I couldn't get Norton to save the files to an external drive, even though the confirmation dialog said it had.

So if Norton's cloud backups will be your first backup system, you unfortunately won't be able to use it to properly cover your butt (fave.co/3S3FYEX). It's definitely better than nothing and a good start, though. And if you already have a good backup protocol in

place, setting up these cloud backups at least further ensures ransomware can't lock you out of your most important files.

Password manager

Norton's password manager is simple but good—a refreshing change from services that feel stripped to the bone. Setup is easy, too. Norton asks you to create a separate vault password, then prompts you to download a recovery key. (You can't recover your account otherwise if you forget your vault password.)

Afterward, you can use the Norton Password Manager mobile app to enable passwordless authentication for logging into your vault. It greatly simplifies an otherwise cumbersome system where two passwords are required to access your vault (one to get into your Norton account, then another to unlock the vault), and it's seamless, though the authentication approval is a little slow to register. You can access your vault through the website, a browser extension, or the mobile app.

One odd quirk I encountered during my review period: You only see different font colors for numbers, symbols, and letters when generating a password, but not afterward. You also can't set the clipboard to automatically clear after a certain time if you copy a password.

VPN

The interface for Norton's VPN is clean and easy to understand, but almost too simplified. For starters, you can only choose your location by country and not a specific city. Also, your settings are limited to toggle switches for turning on auto connect, auto VPN (VPN activates on unsecured Wi-Fi networks), the kill switch (it blocks internet access if the VPN abruptly disconnects), and ad tracker blocking. You can also add apps to the split tunnel feature, which keeps the VPN from routing their traffic.

Speeds while using the VPN were inconsistent during my light testing—for example, while connected to the U.S. server, I got anywhere
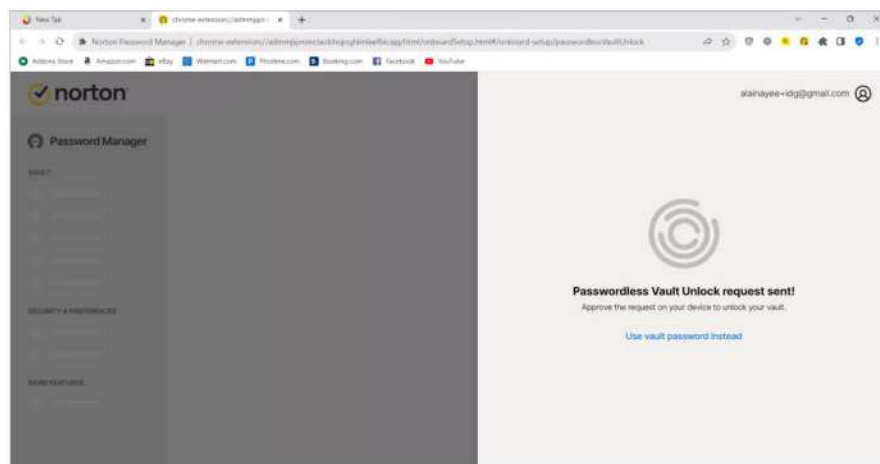
The Norton Password Manager mobile app enables passwordless authentication for logging into your vault.
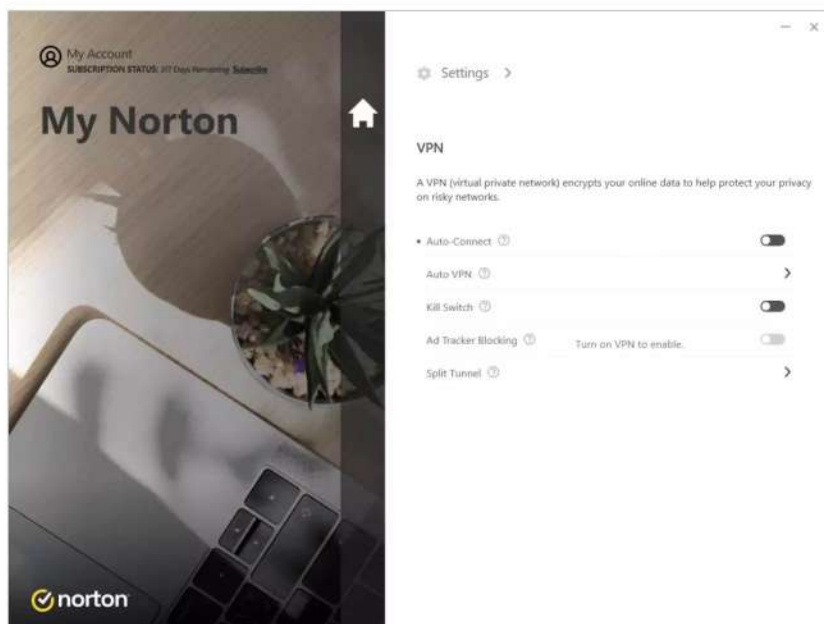
Norton's VPN settings are bare-bones.

from about 88 percent of my normal download speed to as little as 29 percent. If you're stuck on a slower connection, that could hurt a lot.

Countries supported are Australia, Austria, Belgium, Brazil, Canada, Czechia, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Romania, Singapore, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. You can only access the VPN through the My Norton interface.

Parental controls

You can set up Norton 360 Deluxe's parental controls quickly. Just install the Norton Family app, as well as the Norton Family browser extension, on your kid's PC. Then set up a child profile for them.

Once in place, you can track web, search, video, and app activity, as well as restrict access based on time of day. On iOS and Android, you can also restrict access based on app (Android) and get alerts if the device leaves a specific location.

Like the rest of the Norton website interface, statistics and settings are streamlined and easy to navigate, though there are some limitations. For example, you can only monitor YouTube and Hulu site
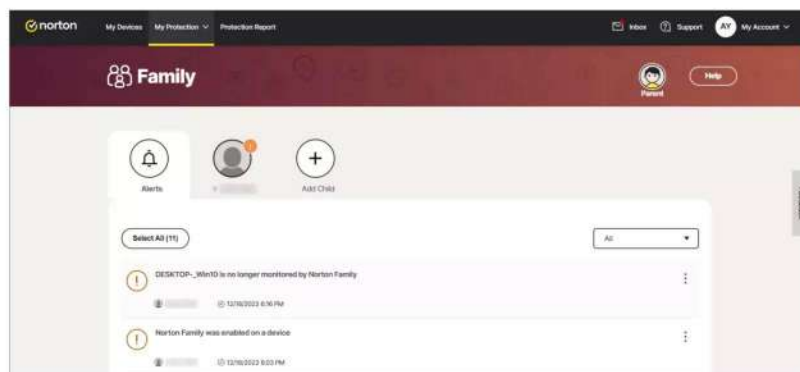
Norton's parental controls (Norton Family) are accessed through a web browser.

usage on mobile in Norton's mobile browser—you can't do so within apps or website embeds.

PC utilities

Included with Norton are several PC tools—though most are duplicates of existing Windows features.

Optimize Disk is Norton's version of Windows Disk Defragmenter—and honestly, it's not necessary. According to Norton, it focuses on defragging of hard disk drives. You're better off using Windows for disk optimization, which already treats hard drives and SSDs with the appropriate protocols (fave.co/48Aiqyi).

File Cleanup gets rid of temporary files held by Windows and any lingering Internet Explorer files. (Yep, Internet Explorer—presumably, Norton's serving people clinging to dead versions of Windows; Edge is not yet supported.) Again, you can use Windows' own tool for this (fave.co/3vAgS8Z).

Startup Manager lets you view and manage which apps automatically launch with Windows startup. You can easily use Windows' own management setting for this by typing startup apps in Windows search.
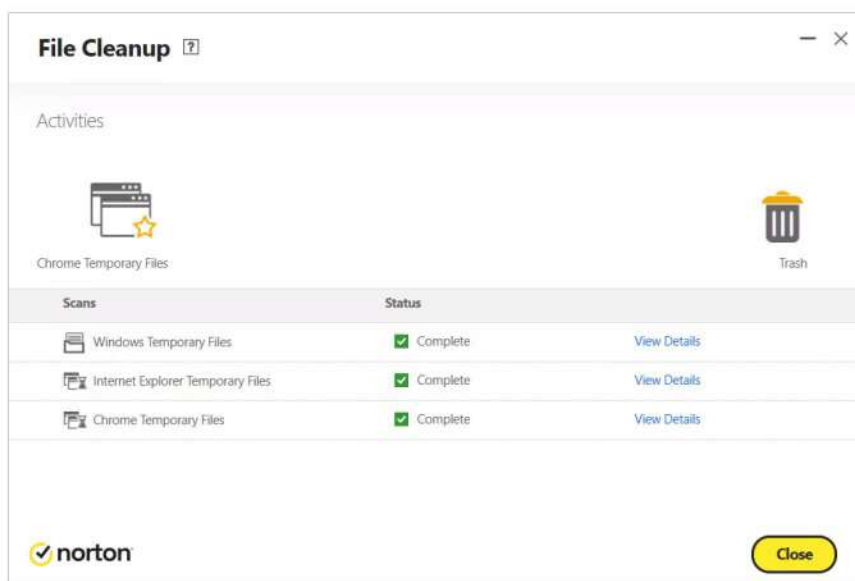
Yes, Norton still concerns itself with Internet Explorer files. (Legacy Windows users…it's time to upgrade, friends.)

While there's nothing wrong per se with using these utilities—Norton's attempt to centralize them isn't a bad impulse—introducing a third-party into the mix is extraneous. The only truly interesting tool is Graphs, which shows you a history of system use (installations, downloads, optimization, virus detections, quick scans, and alerts).

Dark web monitor

You can give Norton information like your email addresses (up to five), physical addresses, phone numbers (up to five), mother's maiden name, driver's license number, insurance info (up to five), credit card numbers (up to 10), bank account (up to 10), and gamertags (up to 10).

If you're like most people, you'll get an instant hit for your email addresses if you use
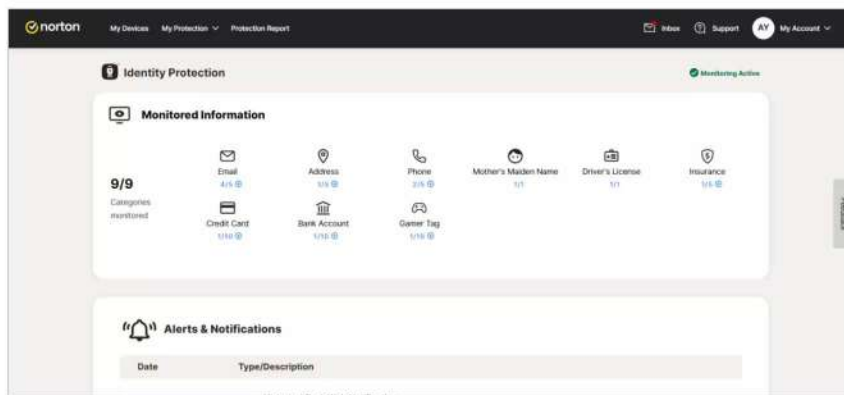
Dark Web Monitoring keeps an eye out for leaked data about you.

them often, but the list isn't nearly as comprehensive as using HaveIBeenPwned. com's lookup tool. I consider this an extra method for getting an alert, but not something to rely on for full coverage.

Privacy monitor

Data broker websites scoop up information about you from public records and other databases that buy data. (The latter is why privacy policies are so important—companies that you interact with can and do sell your information.) Depending on what they find, these websites can put your name, birthdate, current and past addresses, phone numbers, and relatives into just about anyone's

hands, and removing yourself from these sites can be like a game of whack-a-mole.

Norton asks for a surprisingly minimal amount of information to run a search for you on these types of sites—but the results aren't as comprehensive as those of some other services. You'll also have to pay for an upgrade to Privacy Monitor Assistant to have them handle the legwork of removing your information.

Secure browser

For those who don't want to deal with keeping Chrome secure, Norton 360 Deluxe offers an alternative—Norton Secure Browser. It's based off the same Chromium code as
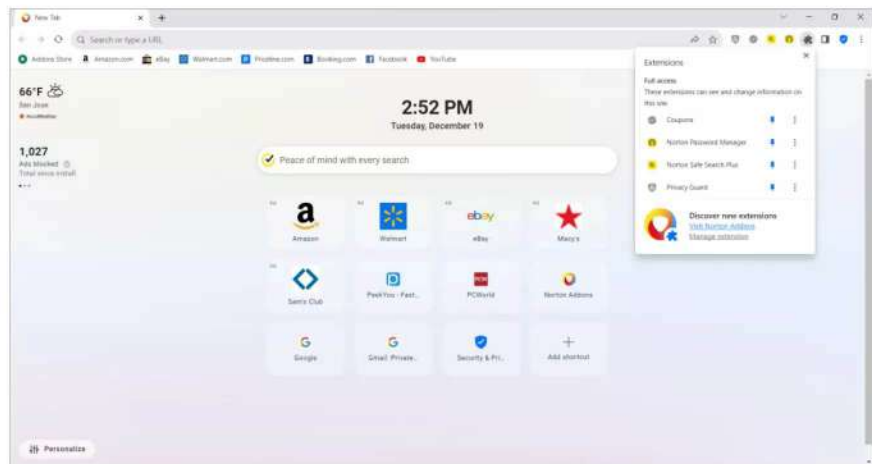
Norton Secure Browser comes with the Norton Password Manager, Norton Privacy Guard, and Norton Safe Search Plus extensions installed.

Google's browser, but the experience is more locked down.

Out of the gate, Norton Secure Browser comes with the Norton Password Manager, Norton Privacy Guard (which blocks trackers and some ads), and Norton Safe Search Plus (which verifies links) extensions installed, and it only supports a limited number of optional browser extensions. (You can still install extensions for big rival password managers such as Bitwarden, Dashlane, and 1Password, so you're not completely locked into Norton's ecosystem.)

Overall, it's a Chrome-lite experience, which has the upside of narrowing how much trouble you can get yourself into. On the flip side, it's not foolproof. You can't install a separate ad blocker, like uBlock Origin, that blocks sponsored links. In fact, the Safe Search Plus extension will put a green checkmark on some sponsored links for downloads that are not the official, primary site—which in my book opens users to potential risk.

Customer support

You can get help directly within the app, from both the My Norton and Classic views. Norton also offers support pages (fave. co/48zYCva) and community forums (fave. co/3HIjiuR) on its website, as well as technical support through social media, chat, and phone assistance (fave.co/48ywKrn). For simpler questions, the in-app help and support pages are a good place to start, while the forums and company support are better for troubleshooting.

Incidentally, if you're looking for the version info for your Norton app installation, you can access it through Help > About.
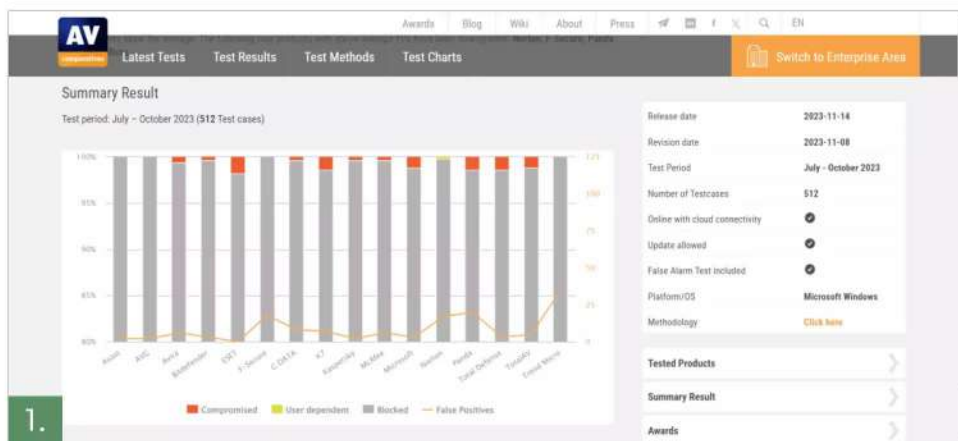
Updates and maintenance

Virus and app updates run automatically by default, but you can run the LiveUpdate feature manually if you want to check for pending updates. It checks for any changes to the antivirus protection, process protection, and Norton app.

PERFORMANCE

In tests performed by leading security research institutes, Norton generally performs well—at least when it comes to online protection. In AV-Test's zero-day attack and malware tests for September and October 2023, fave.co/420gM6M (the most current as of this article's publishing), Norton detected 100 percent of the threats.
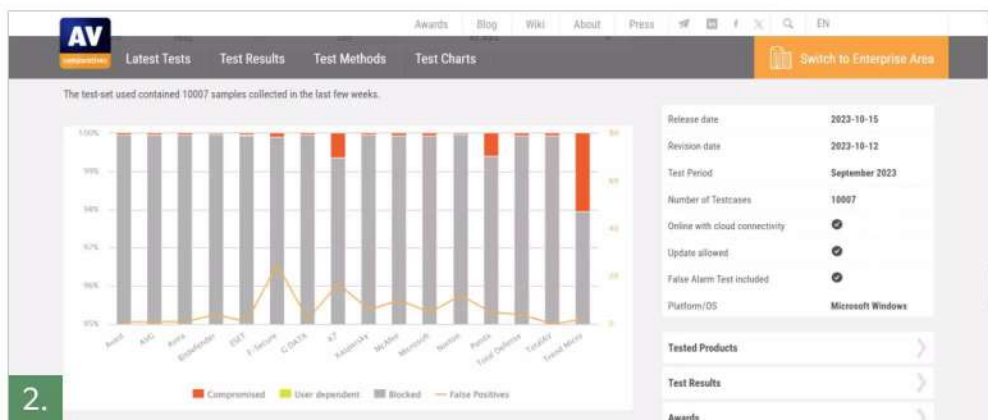
Similarly, in AV-Comparatives' real-world protection test (1) for July through October 2023 (fave.co/48RHPDy), Norton blocked 99.8 percent of the 512 test cases. However, it also had 17 false positives when blocking domains or files, one of the highest numbers among the software packages. (For comparison, ESET posted zero false positives, while AVG and Avast had two.) In practical terms, this could

1.

offline detection rate, while still also offering a 99.98 percent online protection rate and fewer false alarms (just four).

Norton did not participate in AV-Comparatives' November 2023 Advanced Threat Protection Test (fave.co/4b1LeBJ), which evaluates a security suite's resistance to more sophisticated, targeted attack methods like malicious scripts and fileless attacks.

cause unwanted hassle or stress when trying to access a legitimate website or start a download.

Meanwhile, when tasked with the 10,007 samples in AV-Comparatives' September 2023 malware protection test (**2**, fave.co/3SDzNsW), Norton 360 scored an 86 percent offline detection rate, 99.7 percent online detection rate, and a 99.98 percent online protection rate, with 12 false positives. Generally the online protection score matters most—but the offline detection score highlights how heavily Norton relies on an active internet connection for full protection. In contrast, rival Bitdefender tops the charts with a 98.2 percent

For PC performance, Norton 360 Deluxe can have a notable effect on common tasks. You'll see it less in everyday activities, as evidenced by PCMark 10 (fave.co/3SFGue1), a benchmark that simulates web browsing, video chatting, gaming, and file editing in open-source programs like GIMP and

2.

Norton 360 Deluxe ticks all the right boxes.

LibreOffice for images and documents. When idle in the background, watching for real-time threats, Norton 360 Deluxe had virtually no impact on PCMark 10's test scores. But if a full scan ran continuously during the benchmark, the results dropped by about 6 percent.

When using Microsoft Office apps (as simulated by UL Procyon, fave.co/3QXmyRJ), the performance drop gets bigger—an almost 10 percent dip during a full scan, and roughly 6 percent at idle. That difference grew biggest when running our Handbrake encoding test, with a 22 percent decrease during a full scan and 11 percent on idle.

One thing these numbers don't show, however, is how Norton typically handles full scans. After an initial full scan, subsequent ones look for changed or new files—which speeds up the scan time and the drag on system resources. And Norton

schedules full scans by default for off-hours.

Still, if you handle files often—especially if you're on a mid-range or budget PC—Norton's affect on your PC performance is something to consider.

BOTTOM LINE

Norton offers a lot—but its strength is its Achilles heel, too. You get broad, fairly comprehensive protection, but there are extras that don't really serve much use. This security suite would benefit from a unified interface and a lighter impact on system performance. However, if you're seeking an all-in-one solution, this one still ticks the right boxes. ⏻

Norton 360 Deluxe

★★★★☆

PROS
- Strong antivirus protection.
- Wide protection against major online threats.
- Simple, straightforward features.

CONS
- Performance impact on some PCs.
- User interface would benefit from consolidation.
- Upselling of additional services.

BOTTOM LINE
Its interface is a bit unruly, but overall Norton 360 Deluxe offers strong antivirus protection and an excellent spread of protective features that include a password manager, VPN access, automated cloud backups, and Dark Web Monitoring. PCs with modest hardware can experience a performance hit during scans, however—something to consider if you often work heavily with new or altered files.

From $20

Kingston NV2 SSD: PCIe 4.0 for penny pinchers

This bargain PCIe 4.0 SSD from Kingston is NVMe, so it's of course fast—just not as fast as most others. **BY JON JACOBI**

You won't find a more affordable PCIe 4.0 SSD than Kingston's NV2. It's slower than the vast majority of its peers, but, being NVMe, it's still adequate for most users and everyday tasks.

FEATURES

The NV2 is a PCIe 4.0 x4, 2280 form factor (22mm wide, 80mm long) M.2, NVMe SSD utilizing a DRAM-less (HMB or host memory buffer) design. The NAND is 144-layer Kingston-labeled QLC handled by a Silicon Motion SM2267XTV controller.

We tested the 1TB capacity of the NV2, but rated performance varies greatly by capacity: For the 250GB capacity, it's 3GBps reading/1.3GBps writing; for the 500GB and 1TB capacities, it's 3.5GBps/2.1GBps; and for the 2TB and 4TB capacities, it's 3.5GBps/2.8GBps.

The NV2 is warrantied for three years or 320TBW (terabytes that can be written) per terabyte of capacity. Those are paltry numbers compared to most NVMe SSDs, and the low TBW is a dead giveaway that the NAND is QLC.

That said, 320TBW per TB isn't the lowest rating we've seen: The Sabrent Rocket Q4 (fave.co/43pPaXP), Corsair MP600 Core Mini (fave.co/3O4uZtG), and Crucial P3 (fave.co/3HY15Fn)—all QLC

IMAGE: KINGSTON

drives—are rated for 225TBW/TB, 250TBW/TB, and 220TBW/TB, respectively.

You *are* taking a bit of a chance on the NV2 and QLC drives in general, though endurance is generally understood to be greater (often considerably) than vendor TBW ratings, which are factoring in financial liability. Not only that, but most users write far less data than they think.

Still, you didn't think you'd get Seagate-like backing at these prices, did you? What prices are those? See below.

PRICE

At the time of this writing the 25GB NV2 was $28, the 500GB was $38, the 1TB drive cost $52, the 2TB one was $100, and the 4TB was $187, all on Amazon, fave. co/48SmrxW (Kingston's MSRP is $10 to $30 higher). Those prices, folks, are a comparative pittance.
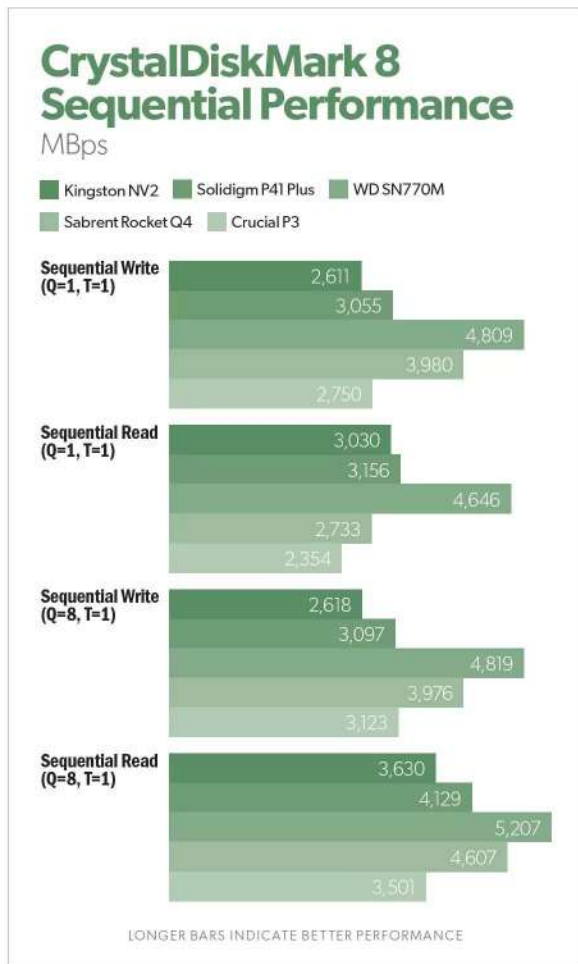
PERFORMANCE

All NVMe SSDs are fast—we are comparing the thoroughbreds of storage here. But the NV2 is definitely one of the slowest such devices we've tested. It ensconced itself in next-to-last place by a comfortable margin, just ahead of the Crucial P3 (fave.co/3HY15Fn), a very similar design but only PCIe 3.0.

The Kingston NV2 in its commodity retail packaging.

So in point of fact, the NV2 is the slowest PCIe 4.0 SSD we've ever tested, and it's not even particularly close to the next slowest— the Solidigm P41 Plus (fave.co/47y2yuV).

While slower than most, our 1TB NV2 actually exceeded Kingston's ratings (see above). Note that Kingston was unwilling to fill out our fact-check sheet, so we quoted the ratings from the company's website.

Again, the NV2 was off the NVMe performance pace in CrystalDiskMark 8's 4K performance tests. Only the PCIe 3.0 Crucial P3 was slower, and not in every test.
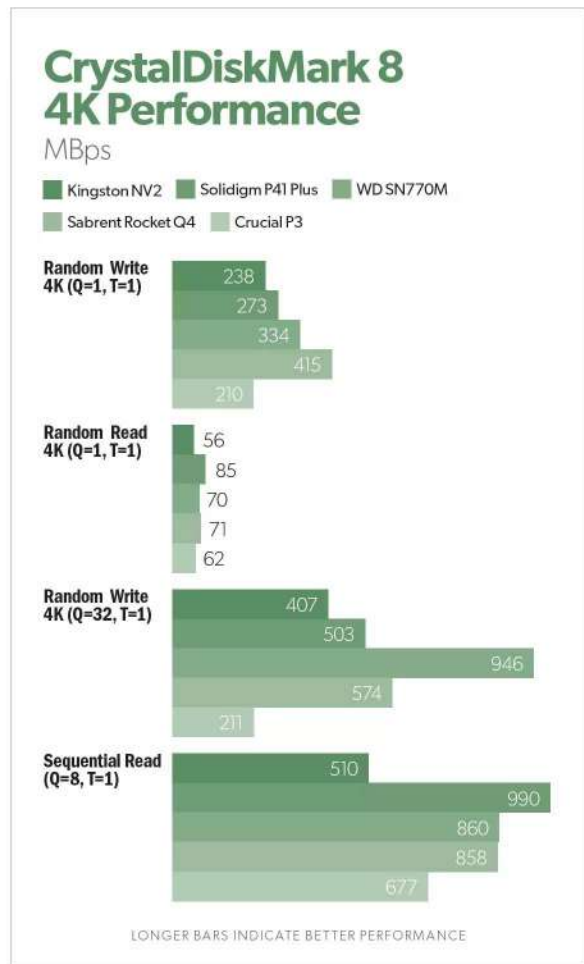
Our 48GB transfers were a relative jaunt for the NV2, which finished tied with or in

CrystalDiskMark 8 Sequential Performance

MBps

- Kingston NV2
- Solidigm P41 Plus
- WD SN770M
- Sabrent Rocket Q4
- Crucial P3

Test	Kingston NV2	Solidigm P41 Plus	WD SN770M	Sabrent Rocket Q4	Crucial P3
Sequential Write (Q=1, T=1)	2,611	3,055	4,809	3,980	2,750
Sequential Read (Q=1, T=1)	3,030	3,156	4,646	2,733	2,354
Sequential Write (Q=8, T=1)	2,618	3,097	4,819	3,976	3,123
Sequential Read (Q=8, T=1)	3,630	4,129	5,207	4,607	3,501

LONGER BARS INDICATE BETTER PERFORMANCE

CrystalDiskMark 8 4K Performance

MBps

- Kingston NV2
- Solidigm P41 Plus
- WD SN770M
- Sabrent Rocket Q4
- Crucial P3

Test	Kingston NV2	Solidigm P41 Plus	WD SN770M	Sabrent Rocket Q4	Crucial P3
Random Write 4K (Q=1, T=1)	238	273	334	415	210
Random Read 4K (Q=1, T=1)	56	85	70	71	62
Random Write 4K (Q=32, T=1)	407	503	946	574	211
Sequential Read (Q=8, T=1)	510	990	860	858	677

LONGER BARS INDICATE BETTER PERFORMANCE

The Kingston NV2 was hardly the fastest NVMe SSD we've tested, but 3GBps is still very fast in the grand scheme of things.

The Kingston NV2 would not be our choice to run your operating system off due to the slower 4K transfers it produces.

front of everything but WD's excellent TLC SSD, the SN770M (fave.co/3SjNQDn). These kinds of copies are where most users will be observing a progress bar, so they have the most salient impact on performance satisfaction.
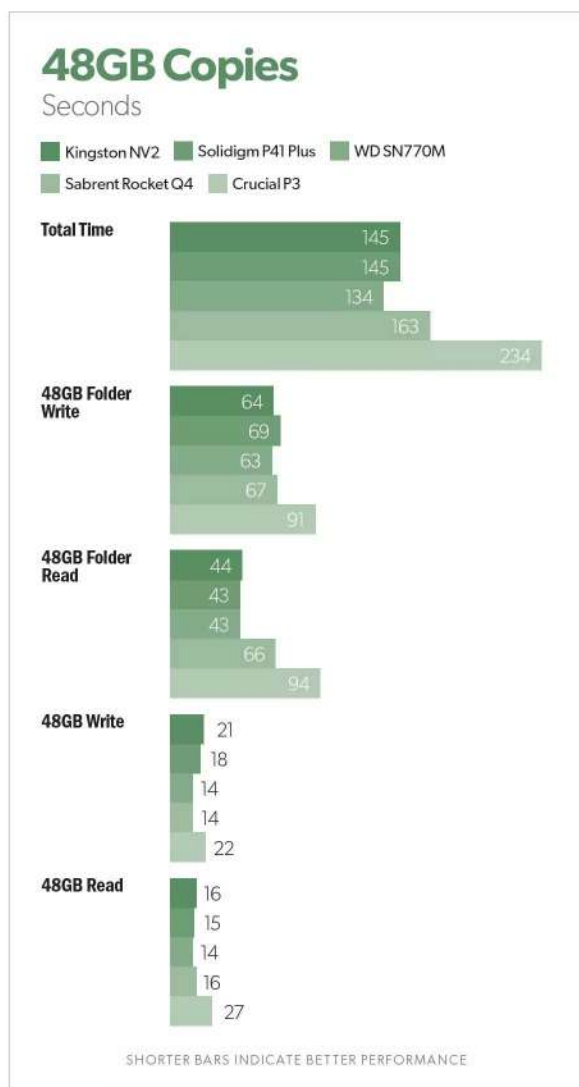
The 450GB write was where the NV2 basically fell off a performance cliff, plummeting to an average write speed of
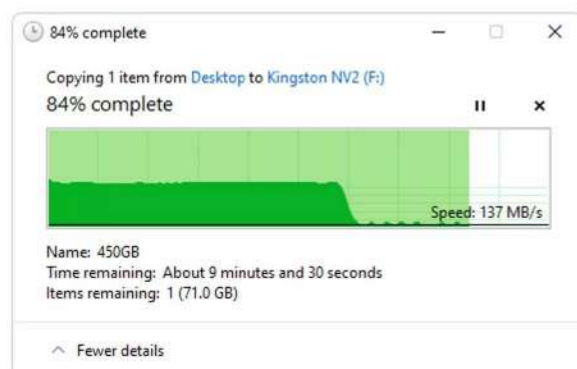
140MBps when it ran out of secondary (QLC written as SLC) cache. Keep in mind that our test model was a 1TB drive, while all the others in the chart were 2TB with more NAND for secondary caching. No doubt a 2TB or 4TB model would have finished with a more competitive time.

On the page opposite you can see the drop in sustained write speed illustrated. The

48GB Copies
Seconds

■ Kingston NV2 ■ Solidigm P41 Plus ■ WD SN770M
■ Sabrent Rocket Q4 ■ Crucial P3

Total Time
- 145
- 145
- 134
- 163
- 234

48GB Folder Write
- 64
- 69
- 63
- 67
- 91

48GB Folder Read
- 44
- 43
- 43
- 66
- 94

48GB Write
- 21
- 18
- 14
- 14
- 22

48GB Read
- 16
- 15
- 14
- 16
- 27

SHORTER BARS INDICATE BETTER PERFORMANCE

450GB Write
Seconds

■ Kingston NV2 ■ Solidigm P41 Plus ■ WD SN770M
■ Sabrent Rocket Q4 ■ Crucial P3

48GB Folder Write
- 1,405
- 771
- 136
- 143
- 208

SHORTER BARS INDICATE BETTER PERFORMANCE

We had to extend the axis for this chart as the 1TB NV2 was so slothful compared to others.

🕐 84% complete — □ ✕

Copying 1 item from Desktop to Kingston NV2 (F:)
84% complete ‖ ✕

Speed: 137 MB/s

Name: 450GB
Time remaining: About 9 minutes and 30 seconds
Items remaining: 1 (71.0 GB)

∧ Fewer details

BOTTOM LINE

Yes, if you're on a tight budget and can't afford anything else. It's also suitable for external storage where the USB and even Thunderbolt busses aren't fast enough to warrant a top-tier SSD.

On the other hand, definitely skip the NV2 if you're an enthusiast or prosumer regularly writing very large amounts of data. It's also not the optimal drive for running an operating system due to the relatively slothful 4K performance.

tiny bumps are the occasional jump up to 400/500MBps. The NV2 spent the majority of the time at the slower rate.

Again, I must point out that we're talking NVMe here, which is far faster than any other type of storage you're likely to employ. But within those boundaries, you're definitely getting what you pay for—or what you didn't pay for, more precisely.

The Kingston NV2 is great if you're on a tight budget and you can't afford anything else.

HOW WE TEST

Drive tests currently utilize Windows 11, 64-bit running on an X790 (PCIe 4.0/5.0) motherboard/i5-12400 CPU combo with two Kingston Fury 32GB DDR5 4800MHz modules (64GB of memory total). Both 20Gbps USB and Thunderbolt 4 are integrated to the back panel and Intel CPU/GPU graphics are used. The 48GB transfer tests utilize an ImDisk RAM disk taking up 58GB of the 64GB of total memory. The 450GB file is transferred from a 2TB Samsung 990 Pro which also runs the OS.

Each test is performed on a newly formatted and TRIM'd drive so the results are optimal. Note that in normal use, as a drive fills up, performance may decrease due to less NAND for secondary caching, as well as other factors. This can be less of a factor with the current crop of SSDs with far faster late-generation NAND.

Caveat: The performance numbers shown apply only to the drive we were shipped and to the capacity tested. SSD performance can and will vary by capacity due to more or fewer chips to shotgun reads/writes across and the amount of NAND available for secondary caching. Vendors also occasionally swap components. If you ever notice a large discrepancy between the performance you experience and that which we report, by all means, let us know. ⏻

Kingston NV2

★★★★☆

PROS
- Outstandingly affordable.
- Very good real-world performance.

CONS
- Short three-year warranty with low TBW rating.
- 150MBps writing off cache.

BOTTOM LINE
If you're on the hunt for the least expensive PCIe 4.0 NVMe SSD, then the Kingston NV2 will likely appear at the top of the list. Performance is more than adequate for the average user, but it's not for pros banging on it with lots of data.

From $28

HP Spectre Foldable: A truly futuristic laptop

A folding laptop that almost does it all. **BY DOMINIC BAYLEY**

Much fanfare has been made about the HP Spectre Foldable since the laptop's launch. So does it live up to all the hype? The simple answer from a design perspective is that absolutely it does. This 17-inch laptop does exactly what its name

implies, folding down the middle of its continuous OLED display and converting from a laptop to a desktop to a tablet and vice versa.

It isn't a new concept. I've seen the same kind of versatility in likes of the Asus Zenbook 17 Fold OLED. But it does feel a little more refined: From the design heights the

Zenbook achieved, the Foldable goes one further, slimming down in size, shedding some weight, and rocking the most unobtrusive fold I've seen to date.

The one downside is that the Foldable shows off only middling CPU power. It also costs a whopping $4,799 at checkout. If you're not a power user, the middling performance may well be of no consequence, but if you're expecting this laptop to pull out all the stops for heavy productivity work, then all its wonderfully bendy circus tricks may not quite be enough.

SPECIFICATIONS

Right now, there's just one configuration of this laptop available for purchase. It features an Intel i7-1250U, 16GB of DDDR 5 RAM, and integrated Intel Iris Xe graphics. The full specifications are as follows:

CPU: Intel i7-1250U

RAM: 16GB DDR5/5200 MHz

Graphics: Intel Iris Xe

Display: 2.5K (1920×2560), Foldable, touch-sensitive, OLED, 99.5 percent DCI-P3 color gamut, VESA TrueBlack HDR compatible, TUV+Eyesafe for low blue light

Storage: 1TB PCIe Gen 4 NVMe

Webcam: HP True Vision 5MP IR camera

Connectivity: 2× Thunderbolt 4 ports (USB Power Delivery and DisplayPort 1.4)

Networking: Wi-Fi 6E, Bluetooth 5.3

Battery capacity: 94.3 WHr

Dimensions: 10.91×14.81×0.33 inches (unfolded), 10.1×7.53×0.84 inches (folded)

Weight: 3.58 pounds (with keyboard attached), 2.99 pounds (without keyboard)

Cost: $4,999.99 (base price)

DESIGN AND BUILD

To me, using the Spectre Foldable is like playing with an '80s Transformer that I just have to put through its paces. But in this case, instead of vehicle and transformer mode, it's the laptop's three main forms that have me enthralled—desktop, laptop, and tablet. Suffice to say, this laptop is incredibly fun to use, but it's also a pragmatist's dream, a marvel of engineering that really deserves

The HP Spectre Foldable converts from a laptop or tablet to a 17-inch desktop PC.

praise for what its design will do for your working life, if you dare to make use of it.

I was eager to do just that, and it made me far more reactive to my work environment. The biggest boon for me was that I could work from anywhere, without the usual restraints placed on me by my Dell Vostro's simple clamshell design.

On the bus in 12.3 laptop mode, for example, the Foldable proved more compact and less cumbersome than my 15-inch Vostro, which substantially sped up output. Reaching home, in a few seconds I could lift off the keyboard and expand it out at the fold to become a 17-inch tablet. This was my preferred form for researching laptop stats while simultaneously watching video recipes to inspire dinner.

Pulling out the kickstand and placing the Bluetooth keyboard out in front converted the laptop into a desktop PC and monitor—the mode that dominated my working day. This bestowed the kind of generous 17-inch visuals I'd usually have to go into the office for but could now get anywhere—on a park table, in my local café, or at the library, which really streamlined my workday.

For all that versatility to work, HP had to really do some lateral thinking on the design.

The laptop's kickstand is thin but very sturdy.

In tablet mode the laptop is remarkably thin—it measures just 0.33 of an inch thick (14.8×10.9×0.33 altogether). This keeps the weight down to just 2.99 pounds, which makes it both smaller and lighter than the Asus Zenbook Fold OLED (14.9×11.32×0.5 inches and 3.31 pounds).

In laptop mode, it measures 10.1×7.53×0.84 and weighs 3.58 pounds, which again is more compact and lighter than the Asus Zenbook 17 Fold OLED's 11.3×7.5×1.25 inches and 3.97 pounds. In this mode in particular, the laptop feels altogether strong and robust. Its recycled magnesium alloy chassis is impressive in your hands, feeling solid and looking slick with a premium metallic-blue finish that could match any flagship model in HP's lineup.

The laptop's desktop mode relies heavily on a slim kickstand to stand it up, which you

can simply pull out from a groove on the rear. That kickstand had more than a few tech journalists worried that it could actually do the job at the first showings of the device, but it turns out it's surprisingly strong and holds the unit up with gusto, without any visible wobbles whatsoever.

A BENDY LAPTOP'S ACHILLES' HEEL

Much of how well a folding laptop works comes down to its fold. In this case, the Spectre Foldable's is the best I've seen. It bends

The HP Spectre Foldable doesn't feel as stable as a dedicated tablet when in tablet mode.

seamlessly, relying on a U-shaped hinge mechanism that's both clever and discreet. HP reinforced the inside with metal plates, so it's remarkably strong—good for 25,000 flexes, according to the manufacturer. The hinge itself is only visible from the sides and the back of the device, so there's no unsightliness either.

HP has customized some of the internal componentry to make the bend as seamless as possible. The laptop's 94.3 watt-hour battery, for example, has been split into two parts and placed down each side to balance the weight out. Equilibrium has been achieved so brilliantly that I never noticed any unequal weight distribution in my testing.

The bend works nearly perfectly in laptop mode. Here, it held the lid firmly

open at just about any angle I wanted it. In tablet mode, however, the lack of a true solid hinge felt a bit awkward at times, like I was holding a very large book open that could sway and jump if I didn't hold it correctly. You simply don't get the solid feeling you get holding a dedicated tablet.

While I did get somewhat used to that, what I never quite got used to is the light glare. The Foldable suffers from the same kind of dreaded reflection in its fold that I saw in the Asus Zenbook 17 Fold OLED, which does impede your view of the display at that point. That said, this problem is a lot less obvious than in its rival, thanks to the crease being a tad smaller—3 mm across instead of 4mm or bigger in the Zenbook—so kudos to HP for achieving that.

KEYBOARD, TOUCHPAD, AND STYLUS

The Foldable's magnetic keyboard slots into place on one side of the display and can be removed just as easily. It measures 12 inches, which doesn't make it full-size, but it feels spacious, nonetheless. The keys too are also very spacious, measuring 1.5 cm each way, which made typing a breeze during the day. With no backlighting, however, their visibility is greatly reduced at night.

The keyboard is covered in a soft pleather-like material that feels tactile and grippy. There's a slight bend in the board between the keys and the trackpad side, which simplifies lifting the keyboard free of the device. The keyboard layout is generous too; you get large arrow keys, a full contingent of Function keys, and both left and right Shift and Control keys.

Magnets in the keyboard clip it into place in two positions—either fully covering one side of a bend or at a position half hanging off the edge. The latter makes a surprising fourth mode possible, which HP calls 1.5 mode. In this configuration one quarter of the lower display remains visible, like you will see in the Asus' Duo dual-screen

laptops. This mode proved ideal for when I needed to cross-reference data.

One really useful point about the keyboard is that you can store it inside the laptop when you fold it down. Doing this, however, isn't without a small problem: There's no groove in the front of the laptop in order to wedge it open again. Consequently the keyboard tends to attach and lift up to the top side when you open. It's a slightly annoying trait that means you'll need to spend time reaffixing it to the bottom at times.

The touchpad is quite large considering the keyboard's dimensions—it measures 11×6 cm. It has a stable click that's neither too soft nor too hard. The Foldable's stylus is also magnetic. It features two programmable buttons and a flat side for easy attachment. It
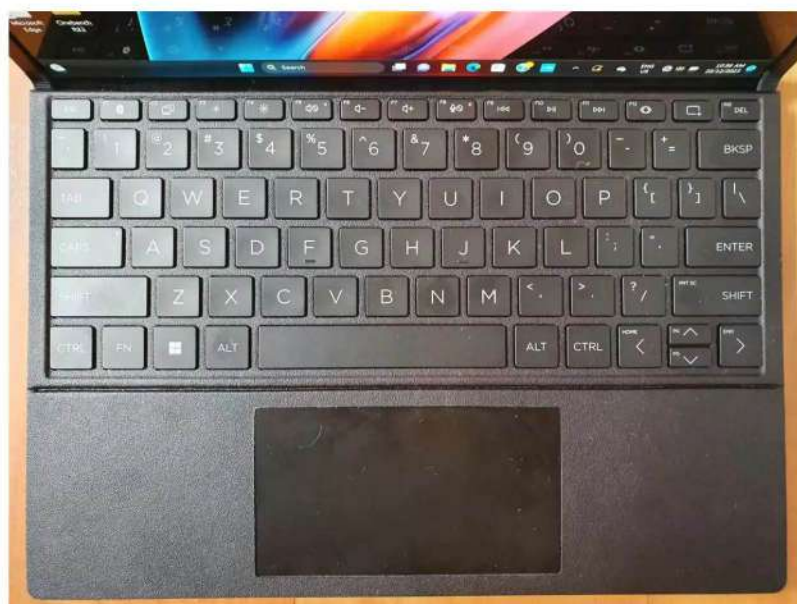
The HP Spectre Foldable's Bluetooth keyboard is magnetic and conveniently charges while connected to the laptop.

maintains a pleasant weight in your hand and is suitably responsive for taking notes and drawing in programs like Microsoft OneNote.

Both the keyboard and stylus recharge on the device, or else you can charge the keyboard separately with a USB-C adapter.

CONNECTIVITY

With just two Thunderbolt 4 ports constituting the Foldable's I/O offering (one on the top left and another on the bottom right of the display when in laptop mode), the laptop is lacking the kind of upfront connectivity you might normally expect from a 3-in-1 laptop.

That said, Thunderbolt 4 ports are some of the more useful and sought-after ports for productivity today, and the two will mostly cover your basic power, file transfer, and presentation needs. Each port bestows a quick file transfer speed of up to 40GB/s and additionally allow you to stream content to two 4K displays or a single 8K display at 60 frames per seconds.

The Foldable also ships with a port adapter that allows you to access two USB-A ports, a HDMI and USB-C passthrough, which I was well glad to have access to, considering the collection of USB-A devices I have. What I did wish the laptop had, however, was a

If you're intending to do creative work, it's entirely possible you could come up with your best work on this panel.

microSD card reader and 3.5mm headphone jack (which Asus's Zenbook has)—these being two things I tend to use a lot of these days. I also found port placement less than ideal, especially when using a USB dock or external drives, which tended to hang awkwardly off the laptop's back.

DISPLAY

The color depth is superb on the Foldable's 2.5K resolution 99.5 percent DCI-P3 OLED display, which brings to life rich and vibrant images and videos. If you're intending to do creative work, it's entirely possible you could do your best work on this panel in Adobe Photoshop or another such program, especially with the MPP 2.0 Tilt pen and touch functionality at your fingertips.

The panel's per pixel illumination means the colors contrast superbly against the very deep OLED blacks. The display also has IMAX Enhanced certification, which means it has IMAX's tick of approval for immersive visuals. It also means it's possible to play content shot specifically for IMAX's expanded aspect ratio on it, which is previously something only HP's x360 laptop could claim to do.

The panel is also suitably bright. I measured a peak brightness of 398 nits by my Lux meter in SDR mode. However, in HDR mode the display provides up to 500 nits peak brightness, which means it's more than visible in sunny rooms.

AUDIO AND WEBCAM

Considering the Foldable is about half the width of the chopping board in my kitchen, the audio it produces is surprisingly decent. It's delivered by a quad array of Bang and Olufsen speakers which sound clear and project volume nicely from the laptop's sides, so that you can hear them no matter what mode you're in.

As you'd expect in such a thin unit, however, treble and mid tones tend to dominate the soundscape, which is almost completely devoid of any bass presence. Testing the speakers with Mariah Carey's All I Want for Christmas, proved the speakers could deliver balanced vocals at medium volume – but Mariah's voice became a little wobbly at higher volumes.

The Spectre Foldable makes use of a HP 5MP camera which produces natural looking images in normal daytime lighting. Its use does, however, come with a small caveat: you'll generally want to use it in laptop mode only since the camera position changes to the left-hand side in desktop mode rendering your image in a vertical orientation, which isn't suitable for meetings.

As long as you use it in the correct orientation, the camera's convenient privacy shutter located on the top right corner (in laptop mode) is a useful feature for when you want to go incognito in your meetings.

PERFORMANCE

The HP Spectre Foldable's i7-1250U CPU belongs to Intel's Raptor Lake-U family, especially made for lightweight productivity laptops like this one. The processor first debuted in February 2022—more than a year ago—which begs the question: Why would HP choose a 12th-gen processor over a more recent and more powerful 13th-gen chip?

At HP's Global Headquarters in Palo Alto California, a HP spokesperson explained to me that this choice came down to power. The Intel i7-1250U chip operates at 9W, whereas Intel's 13th-gen chips have a TDP of at least 15W, which would have forced changes to more facets of the design than HP was willing to alter.

At a glance, the Intel i7-1250U features 10 cores and 12 threads and operates at a base

Cinebench R20
CPU performance

Lenovo Yoga Book 9i Core i7-1355U	4,683
Asus Zenbook 14 Flip OLED Core i7-1360P	3,437
Acer Aspire Vero 14 Core i7-1255U	3,195
Acer Aspire 5 15 Core i7-1235U	3,085
Microsoft Surface Laptop 5 Core i7-1255U	2,984
HP Dragonfly Folio Core i7-1265U	2,594
HP Spectre Foldable Core i7-1250U	2,239

LONGER BARS INDICATE BETTER PERFORMANCE

PCMark 10 Overall
CPU performance

Lenovo Yoga Book 9i Core i7-1355U	6,194
Asus Zenbook 14 Flip OLED Core i7-1360P	5,623
Acer Aspire Vero 14 Core i7-1255U	5,322
Dell Latitude Ultralight Core i7-1265U	5,100
Acer Aspire 5 15 Core i7-1235U	5,073
HP Spectre Foldable Core i7-1250U	4,714
Microsoft Surface Laptop 5 Core i7-1255U	4,230

LONGER BARS INDICATE BETTER PERFORMANCE

frequency of 1.1GHz and a maximum Turbo Boost Frequency of 4.7Ghz. The chip, which is built on a 7 nm manufacturing process, also includes Intel Iris Xe Integrated graphics. In our laptop it fed 16GB of DDR5 RAM and 1TB of SSD storage.

To test the CPU's power, I first zeroed in on Maxon's Cinebench Multi-Threaded benchmark. This benchmark flexes all the cores of a laptop's CPU to show how well it will fare when tasked with the same all-core flexing CPU-load in a real-world task. I graphed the results below.

In UL's PCMark 10 benchmark our laptop's CPU proved just a moderate performer in the comparison lineup, falling in line behind laptops like the Asus Zenbook 14 Flip OLED, Acer Asprie Vero 14, and Dell Latitude Ultralight.

Moving on to the graphics performance, the Spectre Foldable achieved a score of just

1,146 in the 3DMark Time Spy Overall benchmark. While this kind of score isn't unexpected for a laptop with just integrated graphics, it's also not great when held up against scores from our comparisons.

In summary, these results don't tell us a very encouraging story about the Foldable's performance capabilities. They show us a

3DMark Time Spy
GPU performance

Acer Aspire Vero 14 Core i7-1255U	1,815
Microsoft Surface Laptop 5 Core i7-1255U	1,750
Lenovo ThinkPad X1 Nano Gen 3 Core i7-1360P	1,715
Asus Zenbook 14 Flip OLED Core i7-1360P	1,671
Dell Latitude Ultralight Core i7-1265U	1,410
Acer Aspire 5 15 Core i7-1235U	1,301
HP Spectre Foldable Core i7-1250U	1,146

LONGER BARS INDICATE BETTER PERFORMANCE

laptop that has enough power for light productivity tasks like spreadsheet work, word processing, and videoconferencing, but you're not going to want to do any kind of heavy lifting work like video editing or encoding on it—tasks that are likely to run sluggishly on this laptop—at least compared to a more powerful productivity laptop like the Asus 14 Flip OLED.

Laptops with integrated graphics are designed for lightweight graphics tasks anyway, but even accounting for that fact, the Foldable's graphics performance seems to be lacking somewhat also. Again, you shouldn't have any trouble with light tasks like rendering simple 2D images or watching videos, but for more complex tasks like 3D rendering, the Spectre Foldable is going to struggle.

The takeaway is that there seems to be a dichotomy between the laptop's excellent design and its lackluster power offering. The design is undoubtedly brilliant, but it has possibly arrived too early for a suitable chip to provide the kind of performance the laptop requires.

The big question, then, is a personal one: Is the versatility you're likely to get in the Spectre Foldable's design worthwhile for the kind of step-down in performance you might get compared to other 3-in-1s? For me and my simple word processing needs, it is. But then again, I didn't lay down $5,000 for the privilege of using it.

BATTERY LIFE

The HP Spectre Foldable comes with a 94.3WHr battery and a compact 110W USB-C charger. With HP going to enormous lengths to fit such a large battery into the laptop's folding design, I had high hopes the Spectre Foldable could last at least 8 hours, which is the minimum requirement of most office workers.

To find out, I set a 4K movie on repeat in the Windows Film and TV app and switched the Wi-Fi to airplane mode. I also set the volume to 50 percent and plugged in a cheap pair of headphones to keep sound to a minimum. Lastly, I sat back and timed how long it took for the laptop to switch to Standby Mode.

As you can see in the graph below, the Spectre Foldable lasted a respectable 14 hours in laptop mode before running out of juice. This is longer than the Asus 14 Flip OLED,

Battery Life
Minutes

Laptop	Minutes
HP Spectre Foldable Core i7-1250U	842
Asus Zenbook 14 Flip OLED Core i7-1360P	728
Microsoft Surface Laptop 5 Core i7-1255U	626
Lenovo Yoga Book 9i Core i7-1355U	623
Acer Aspire Vero 14 Core i7-1255U	605
Dell Latitude Ultralight Core i7-1265U	536
Lenovo ThinkPad X1 Nano Gen 3 Core i7-1360P	430

LONGER BARS INDICATE BETTER PERFORMANCE
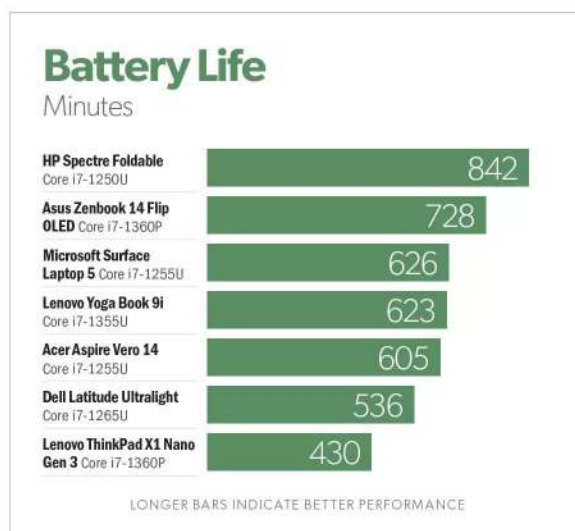
The Spectre Foldable is the best folding 3-in-1 laptop we've seen to date.

Microsoft Surface Laptop 5, and Lenovo Yoga 9i. In a nutshell, it suggests that you can almost assuredly leave your charger at home on an average workday and run the Foldable all day long without needing to recharge.

BOTTOM LINE

There's no doubt the HP Spectre Foldable is the best of the folding 3-in-1 laptops I've seen to date, with a design that seamlessly moves through its different modes like a master craftsperson who has honed their craft over many years. The utility of such a design is undoubtedly huge. That said, the Foldable's unimpressive CPU power is like an unwanted stowaway disrupting the smooth sailing of an otherwise tip-top ship.

Is the Spectre Foldable another example of a technology that doesn't quite live up to

reputation? That depends on what you need it for. In my view, most users aren't going to be troubled by the laptop's power limitations—only creators wanting more oomph for high-end programs are going to have any issue. Either way the laptop's $4,799 price tag should at least give you some food for thought to pause before you buy. You'll have to consider what you really need your productivity laptop to be capable of. ⏻

HP Spectre Foldable

★★★★☆

PROS
- The folding design is ingenious and works well.
- The OLED display is gorgeous.
- Peripherals are magnetic and charge on the device.

CONS
- There are just two ports available.
- The port placement isn't great.
- It lacks performance for power users.

BOTTOM LINE
The HP Spectre Foldable is the best 3-in-1 foldable laptop we've used to date, showing off a number of features that add to user experience and build on what rivals have achieved previously. We just wish it was a little more powerful.

$4,799

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NEXT-GEN WINDOWS LEAK: 6 AI FEATURES THAT COULD CHANGE PCs FOREVER

A NEW REPORT SAYS MICROSOFT IS REBUILDING WINDOWS FROM THE GROUND UP TO INTEGRATE HELPFUL, PRACTICAL AI FEATURES.
BY BRAD CHACOS

There's no question about it: Artificial intelligence is the new hotness in personal computers. An intriguing new report claims Microsoft will push the pedal to the metal even harder with a revolutionary new version of Windows 11 (or 12?) in 2024, designed to make AI helpful at deeply practical levels.

Microsoft just put AI front-and-center with Windows 11's massive 2023 Update (fave. co/4191bRX), which added the Windows Copilot AI assistant and the awesome AI Cocreator features to Paint (fave. co/3R4bl1C). Copilot is coming to Windows 10 (fave.co/3Rcdt7F), too. And Intel, AMD, and Qualcomm have been busy integrating AI-boosting NPUs (neural processing units) to the PC chips destined to hit the streets next year, aiming to enhance tasks with local AI that runs on your computer's hardware rather than hitting up servers in the cloud.

Now an explosive Windows Central report (fave.co/ 3uHMg4W) claims Microsoft is preparing a "groundbreaking" new version of Windows that's absolutely brimming with helpful, practical AI tasks. You should take all leaks with a big pinch of salt, but Windows Central's

reporters are deeply embedded in the Microsoft ecosystem and have a killer track record with Windows leaks.

Read the full Windows Central report for a deep dive into how Microsoft is revamping the very core of Windows to make this happen, and why its unknown whether this AI-enhanced version of Windows will be called Windows 12 or released as a Windows 11 upgrade. For folks who are more interested in what you can actually do with your computer, here are six AI features reportedly coming in 2024's "groundbreaking" Windows overhaul.

AI IN THE WINDOWS SHELL

Windows Central says Microsoft is weaving AI deep into the Windows Shell itself—the graphical interface underpinning the operating system. Paired with an upgraded Windows Copilot, this is the secret sauce that
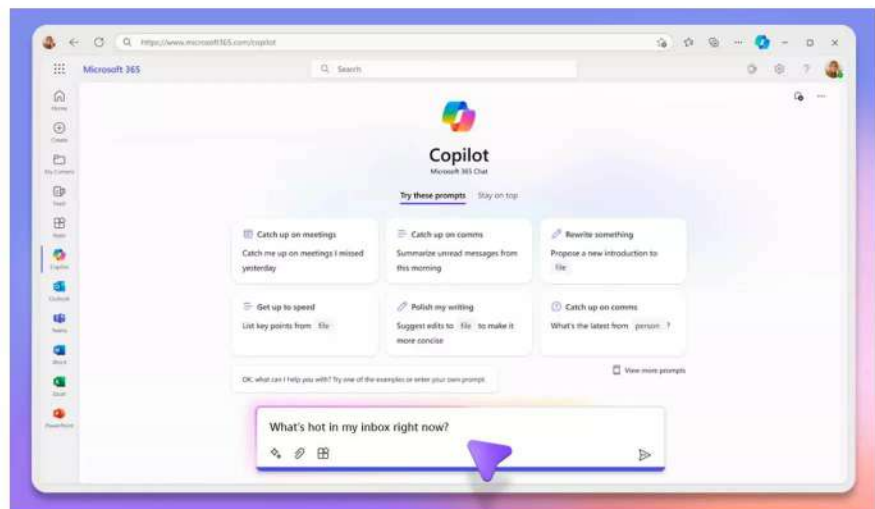
The next version of Windows will feature an upgraded Copilot.

would enable this new version of AI to offer numerous practical features. Such as…

A SMART HISTORY FEATURE

Windows Timeline, a feature that let you see your history of open files and tabs from any PC you've signed in on to jump back into the action, was one of my favorite Windows 10 features—until Microsoft killed it in Windows 11. Windows Central says an AI-powered history feature will return to Windows in 2024. It reportedly allows you to comb through all the apps and sites Copilot remembers, and you can use natural language search to filter results. "For example, you could type 'FY24 earnings' and every instance where that term was on-screen will reappear for you to see and open," Windows Central writes.

SEARCH GETS SMART

That natural language search could extend to the traditional Windows search experience as well, which is good, because Windows 11's search kind of sucks. If you can't remember a file's name, Windows Central says you'll be able to search using queries like "Find me the spreadsheet Bill sent me on Slack two weeks ago." The operating system should be able to understand the query and summon the file on information like that alone.

If *this* happens, smarter search alone would be a killer feature for this new version
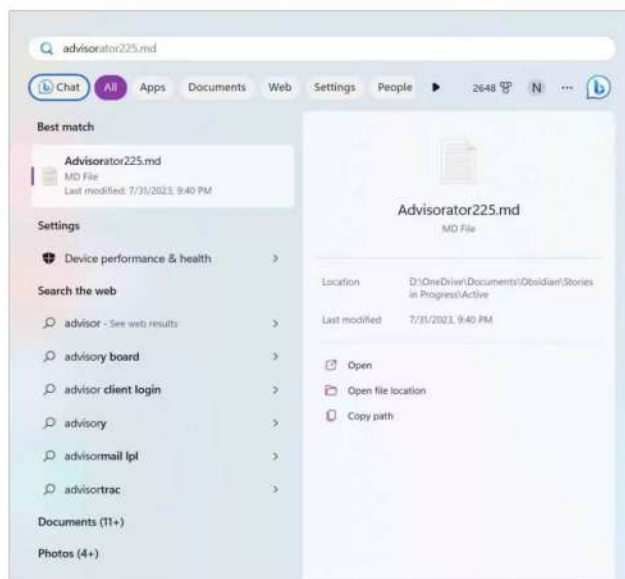
Natural language search would be a lot better than the current Windows 11 search experience.

of Windows. Being able to find files using natural language would be a massive upgrade over what we've got today.

SUPER RESOLUTION

Maybe you've heard of Nvidia's DLSS (Deep Learning Super Sampling) or AMD's FSR (FidelityFX Super Resolution), which use AI and GPU hardware to intelligently increase the resolution in video games and/or increase performance. Nvidia's Video Super Resolution does the same for (you guessed it) videos.

Windows Central says Windows itself will offer some sort of AI Super Resolution option in its 2024 revamp, using onboard NPUs rather than GPUs to upscale the visual quality of games and videos. I expect it wouldn't match the quality of GPU-enhanced upscaling,

but since DLSS and FSR aren't supported by every game, if Microsoft can offer a universal Super Resolution feature that works across the board without active developer support, it could be another killer feature. The proof is always in the implementation pudding with upscaling features, though.

Nvidia's DLSS uses AI to increase the resolution and performance in games such as Microsoft Flight Simulator (pictured).

SMART LIVE CAPTIONS

Microsoft already added Live Captions to videos for Windows 11, but this report says AI will make it even better in the new version of Windows. Live Captions will allegedly be able to translate multiple languages simultaneously in real time, across videos and live calls alike.

AI WALLPAPERS

Windows Central says Microsoft is working on having its AI identify multiple layers in desktop wallpapers, which would allow it to have a parallax-style effect that shifts based on the movement of your mouse or mobile device.

HERE'S TO 2024!

Again, read the full Windows Central report (fave.co/3uHMg4W) for the full scoop on how Microsoft is rearchitecting Windows to make all this AI magic happen along with information on some non-AI features like improved energy efficiency and a new section of the Start menu. It's worth a read for Windows wonks.

All these AI features sound actually helpful and practical for people who aren't media creators, which is more than we can say about most consumer AI features released thus far. If this report holds true, that's an exciting revelation, but there's a potential fly in the ointment.

Windows Central says many of these AI features could require a PC with an onboard NPU, so you'd only be able to use them with a small number of ultramodern laptops. It's likely that many of these groundbreaking Windows AI features would only be able to run on new PCs released in 2024 or later as Intel, AMD, and Qualcomm start their blitz of NPU-equipped AI PCs in earnest. ⏻

It's always been easier for me to help others

than to help myself

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WINDOWS 11'
NEW BACKUP
EVERYTHING YOU N

S
APP:
NEED TO KNOW

WITH A NEW APP THAT MICROSOFT HAS INTEGRATED DIRECTLY INTO WINDOWS 10 AND WINDOWS 11, YOU WILL BE ABLE TO BACK UP YOUR DATA TO THE CLOUD AND SYNCHRONIZE IT WITH OTHER SYSTEMS. THIS FEATURE WORKS SIMILARLY TO MACOS WITH iCLOUD.
BY THOMAS JOOS

Microsoft is providing a new backup app for Windows 11 and Windows 10 that you can use to back up your data. The app is available free of charge in Windows 10 and Windows 11, but it does not offer much flexibility.

Only OneDrive is generally suitable as a backup destination. Anyone who relies on cloud storage can therefore benefit from the new app. Anyone who does not use a Microsoft account or does not want to back up data to OneDrive will not benefit from this app.

Basically, Microsoft is expanding the backup and synchronization options of Windows 10 and 11 with the app, similar to Apple in macOS, iOS, and iPadOS. Users can also use the new app to protect themselves against data loss due to ransomware. You can also use the app to keep multiple PCs and their data and settings synchronized.

WINDOWS BACKUP RUNS IN PARALLEL WITH THE ONEDRIVE CLIENT

To use the new backup app, open the Windows Backup app from the Start menu. Various options are available here that you can use to back up a Windows computer. The settings are independent of the OneDrive client.

You can therefore continue to synchronize a directory on the local computer with OneDrive in the future. If the app does not appear in the list, you should update your Windows system; integration takes place via a Windows update.

The new Windows Backup can back up various folders on the local computer to OneDrive. Incidentally, this works in parallel with other backup options and also in parallel with the Windows 7 backup that is still available in Windows 10 and Windows 11. The new Windows Backup app can only use OneDrive
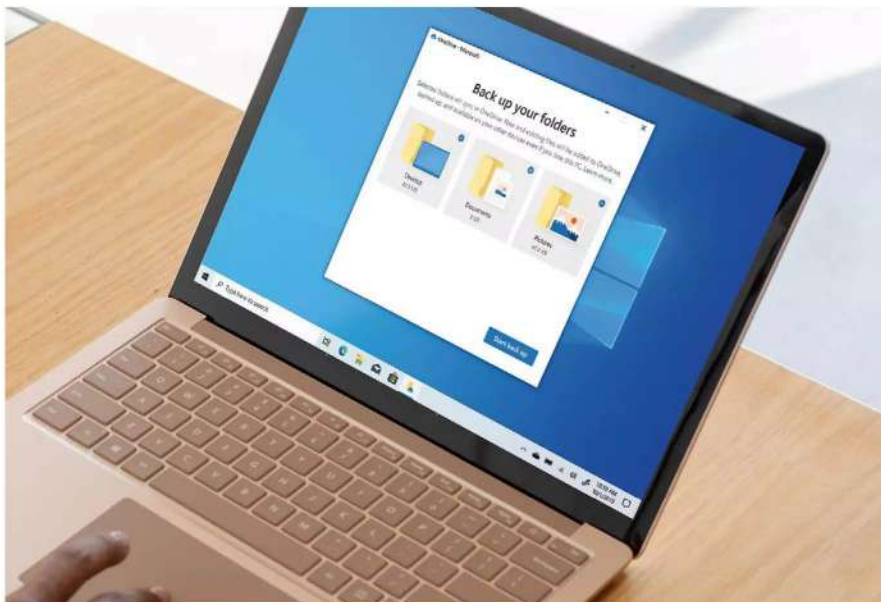
You can use the OneDrive client in parallel with the Windows Backup app.

as the backup destination, while you can also use the classic app to back up data to external drives or the network.

The OneDrive client in Windows 10 and Windows 11 can still be controlled via its icon in the system tray area of the taskbar. In the future, you will therefore be able to synchronize individual files in OneDrive using various tools, back up various folders, and back up data locally or to the network using the classic backup. These three options are not mutually exclusive but run in parallel.

All three apps therefore have their justification and enable very flexible backup methods for Windows workstations with Windows 10 and Windows 11. The Windows Backup app is also ideal if you want to migrate from Windows 10 to Windows 11 or to a new PC with Windows 10 or Windows 11.

FIRST STEPS WITH THE WINDOWS BACKUP

After starting Windows Backup, you will first see the name and type of your PC at the top and when the last backup was performed. Under Folders you can see which folders on the computer were covered by the Windows backup and whether they are currently backed up. You can also see how much storage space the backup of this folder currently requires in the cloud. You can see the available storage space in OneDrive at the bottom of the window.
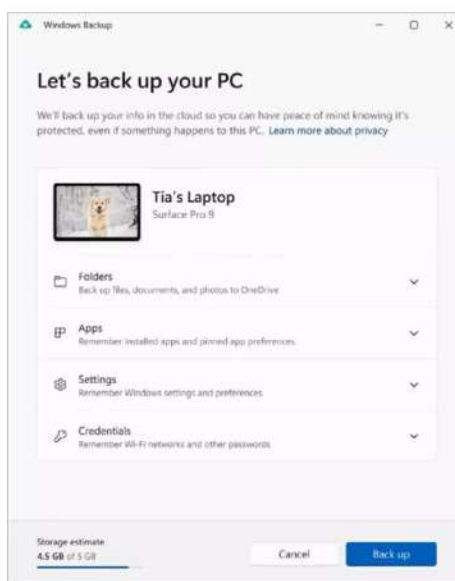
After starting Windows Backup, you will first see the name and type of your PC at the top.

Under Apps you can see whether settings and the app list of the PC are synchronized with the cloud. You can also check under Settings whether the Windows backup also synchronizes options such as customizations. If you log in to another PC with the same Microsoft account, the data is also immediately available here.

The same applies to data from Wi-Fi networks or login data, including passwords. The Windows backup can also save this data to the cloud so that it is available on other PCs. Start the backup with the Backup button.

CONFIGURE THE WINDOWS BACKUP

You cannot customize the Windows backup directly in the Windows Backup app. You can only monitor and start the backup here. To

You'll need to customize your backups in Windows.
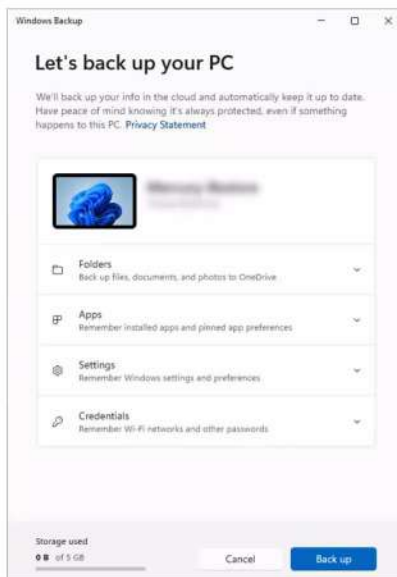
make adjustments, open the settings in Windows 10 or Windows 11 and go to Accounts > Windows Backup.

Use "Manage synchronization settings" to specify which local folders you want to back up to OneDrive. Here you can also see the
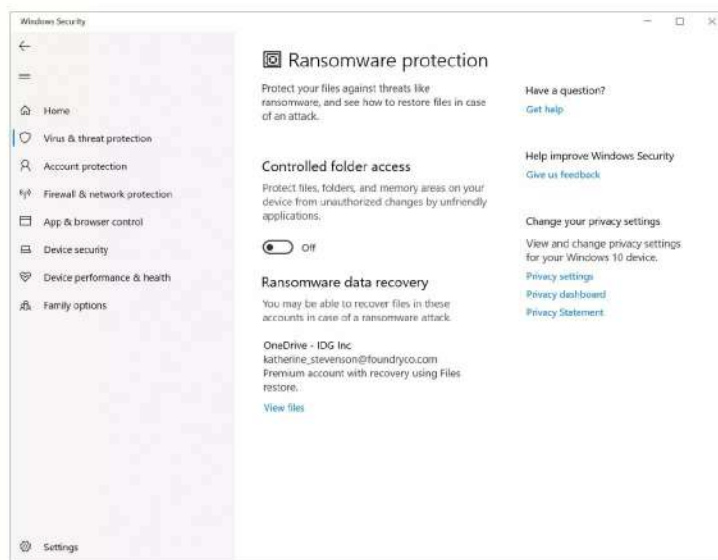
The new app will also protect you from ransomware.

required storage space. You only need to activate the slider for the respective folder at this point.

You can also specify whether you want to back up your settings and the app by activating the respective option under Accounts > Windows backup.

WINDOWS BACKUP PROTECTS AGAINST RANSOMWARE

By synchronizing your important data with OneDrive, you can also protect yourself against ransomware with the new app. Open the Windows Security app and go to Virus and threat protection > Ransomware protection > Manage ransomware protection. You can use "Show files" to go directly to the files in OneDrive to restore them if your computer has been attacked by ransomware.

Additional settings are not necessary, as the Windows Backup app takes over the ransomware protection options of the Windows Security app.

The app is very simple and can be set up quickly. If you use a Microsoft account and are prepared to back up your data to the cloud, the Windows Backup app is a useful backup and synchronization app with on-board tools. ⏻

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How to set up your new computer the right way

Set up antivirus, clear out bloatware, and perform other tasks to keep your PC humming well into the future. **BY BRAD CHACOS**

So you've got a new computer. Awesome! That humble metal box is the key to a wide world of potential. It can help you with everything from juggling your finances to keeping in touch with your family to blowing off some steam on, uh, Steam.

But a new PC isn't like a new car; you can't just turn a key and put the pedal to the metal. Okay, maybe you can—but you shouldn't. Performing just a few simple activities when you first fire it up can help it be safer, faster, and better poised for the future. Here's how to set up a new laptop (fave.co/3qL4oHf) or

IMAGE: ACER

desktop computer (fave.co/3DFIbAR) the right way, step by step, regardless of whether you're running Windows 10 or Windows 11.

RUN WINDOWS UPDATE ON YOUR NEW PC

The first step is by far the most tedious. You shouldn't muck around on the web unless your copy of Windows is fully patched and up to date, period. Now for the bad news: Depending on how long your PC sat on the retail shelf, this could take minutes—or hours. Either way, it has to get done.

Microsoft releases new Windows patches at least once per month. Major feature upgrades for Windows 10 and 11 occurred twice per year in the past, but they will slow to one per year in the future, with fresh features also sprinkled in here and there throughout the year. If your computer isn't fully patched, you could be missing key security fixes and notable new features.

First, make sure your PC's connected to the internet. In Windows 10, open the Start menu and head to Settings > Update and security > Check for Updates. Your system will search for updates and find some. Download and install them, then reboot your computer and do it again…and again…and again…until the update check fails to return new entries. Hopefully it won't take too long, but in worst-case scenarios, updating a new computer can take an hour or more.

On the bright side, Windows will download and install new updates as they roll out in the future. You just have to get over this initial hump!

If your new laptop came with Windows 10 installed, you may see the option to upgrade to Windows 11. We tend to prefer Windows 10 to Windows 11, thanks to some radical interface changes in 11, but you can certainly opt to upgrade if you like. If you want all possible new Windows 11 features, the PCWorld Software Store offers the Windows 11 Home-to-Pro upgrade for $60 (fave.co/3vK5hUN), much less than its usual $100.

INSTALL YOUR FAVORITE BROWSER

Surfing the web in an unfamiliar browser is like
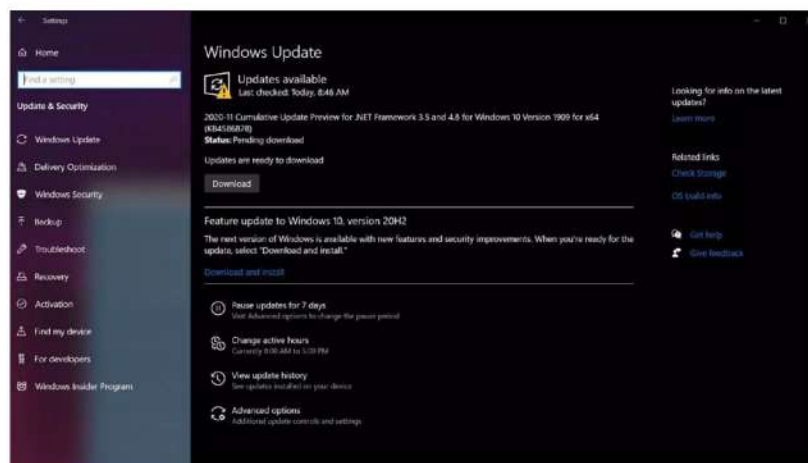
Keep updating Windows until it says you're all caught up.

trying to tango while you're wearing someone else's shoes. It can be done, but it ain't pretty. Here are direct links for Chrome (fave.co/47E5yWE), Firefox (fave.co/3U3P9b8), and Opera (fave.co/3SkyuyE) if Edge isn't your thing.

Windows Security in Windows 10.

Chrome has been our go-to pick for years, but Edge is the best browser you can use right now if you don't mind breaking away from Chrome, and better yet, it's Windows' default. We've recently run pieces extolling the virtues of Firefox (fave.co/3xz10kt), Vivaldi (fave.co/3QrFw1B), Edge (fave.co/3tJIdC2), and Opera (fave.co/3O0zSEc) if you want to play around with your options.

SET UP YOUR NEW PC'S SECURITY

Now that you've slipped into something more comfortable, it's time to get your security ducks in a row.

Windows ships with Windows Security enabled by default (fave.co/3tXSvPP), unless your laptop or desktop includes a third-party antivirus trial. Windows Security is a solid if not overly detailed solution that's dead simple to use, great at sniffing out malware, and probably good enough for most people. It isn't the most full-featured anti-malware

solution out there, though. You can't even schedule scans, and the default Windows Security app doesn't guard against online tricks like phishing. PCWorld's guide to the best antivirus for Windows PCs (fave.co/3CnDHuk) can help you find all the right tools to keep your PC protected.

CLEAN YOUR COMPUTER'S BLOATWARE

With your defenses up, it's time to start shoveling the junk out of your PC.

You can skip this step if you built your own Windows PC. Straight Windows installations don't come with excess junk cluttering up your hard drive, nor do boutique custom rigs like the Falcon Northwest Fragbox (fave.co/3O0A8Da). But boxed PCs from big-name PC makers are inevitably brimming with bloatware.

The easiest way to jettison the junk is by typing "Add and remove programs" into the Windows search box, then selecting the option that appears at the top of the results. Go through the list and uninstall any unwanted programs. Don't delete apps from your hardware's makers—leave software from the likes of Intel, AMD, Nvidia, Microsoft, and HP or Lenovo alone, for example—but feel free to wipe out any bundleware you see. Some of the most commonly preinstalled apps are antivirus trials, Dropbox, Candy Crush, Netflix, Spotify, "App Collections," and others.

When removing bloatware from a new PC, make sure you don't delete apps from your hardware's maker.

If you decide to perform a fresh installation of Windows (fave.co/3O5SBhk) to clear the decks and want to keep some of the software you're blasting away (Office, say), be sure to jot down the product key before initiating the process, using something like Belarc Advisor (fave.co/3TZSpEg) to find it. Going through the apps list and eradicating key offenders should work well enough for most people, though.

FILL YOUR NEW COMPUTER WITH SOFTWARE

Why would you scrap all that junk and clutter? To make room for your own stuff, silly. Brand-new hardware just begs for new software to match!

Outfitting your rig is an intensely personal affair, but if you're looking for suggestions, PCWorld has a guide to the best free programs (fave.co/3J9eIFk) that are so helpful, so handy, so downright useful they should be welcome on pretty much any PC. These review roundups and software guides can also direct you to some of the best programs around:

"The best free Microsoft Office alternatives" (fave.co/3KxJJxG)

"5 free Windows power tools we can't live without" (fave.co/459bHdx)

"The best password managers" (fave.co/3IRkfRz)

"The best PDF editors" (fave.co/3V8Y9bO)

"The best VPNs" (fave.co/3FtTTMs)

"7 free programs every PC gamer needs" (fave.co/3Slo1lx)

"5 free Photoshop alternatives for Windows" (fave.co/3o2gglX)

"How to play DVDs in Windows 10 for free" (fave.co/3g12dZm)

Head toward Ninite (fave.co/32BzNIO) when it comes time to actually install all that software. Ninite lets you install numerous free applications of your choice all at once, even going so far as to automatically disable the bundled crapware that many free programs try to sneak in as part of the installation process. It's a wonderfully handy tool that takes the pain out of loading up a new PC.

If your new laptop came with Windows 11 preinstalled, you might be uncomfortable with its radical new Start menu and taskbar design. Consider checking out StartAllBack (fave.co/3ED7Use) or Stardock's Start11 (fave.co/3Ooi0I4) if so. Both of these $5 programs help you reconfigure the look and feel of Windows 11 in ways the operating system itself doesn't. You can have it back to feeling normal in no time. I've been a staunch personal user of Start11 (and its Windows 10 sibling, Start10) for years. It's great.

BACK UP YOUR NEW COMPUTER

After all that, your PC is finally ready to rock: It's safe, up to date, scrubbed free of junk, and full of software fine-tuned to meet your specific needs. The end is in sight! But we're not done *juuuuuust* yet.

Now that your PC's in fighting shape, it's an ideal time to create a clone or image of your primary hard drive—the one Windows boots from—and save it to another hard drive. A clone or image creates a snapshot replica of your drive, which you can use to boot up Windows if your primary drive
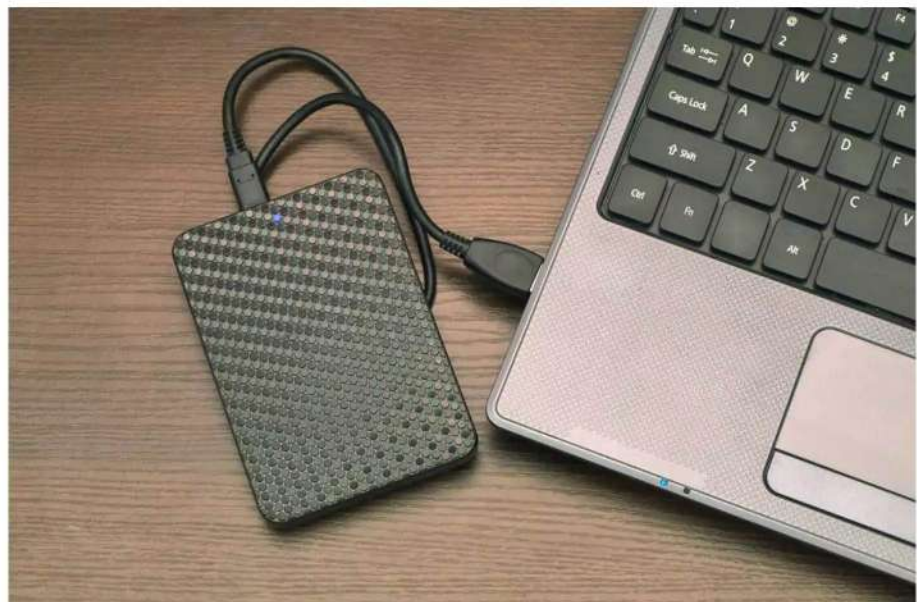
Once you've set up your PC, we recommend you create a clone or image of your primary hard drive and save it to another hard drive.

gives up the ghost. Having an image of your system in its current updated, bloatware free, customized state prevents you from having to do all that previous legwork over again if you ever have to reinstall Windows for any reason.

So what's the difference between a clone and an image? Essentially, a clone creates an exact copy of your hard drive on another drive— files, master boot record, and all. The clone consumes the entire hard drive, but it's plug-and-play if you ever need to use it. Images, on the other hand, create a single, mammoth file containing all the stuff on your PC. It takes a bit more work to get an image backup ready to roll after a disaster, but you have more flexibility in how you store it, since it's essentially just a great big file. Lincoln Spector (fave.co/3OsCk6H) has a more detailed comparison if you're interested.

There are excellent backup tools available that let you create clones and images, which we cover in detail in PCWorld's roundups of the best Windows backup software (fave.co/3nlNb3Z) and best online backup services (fave.co/3FWaMk6). Don't want to pay for data protection? We've also rounded up the best free backup options (fave.co/4255TAz),
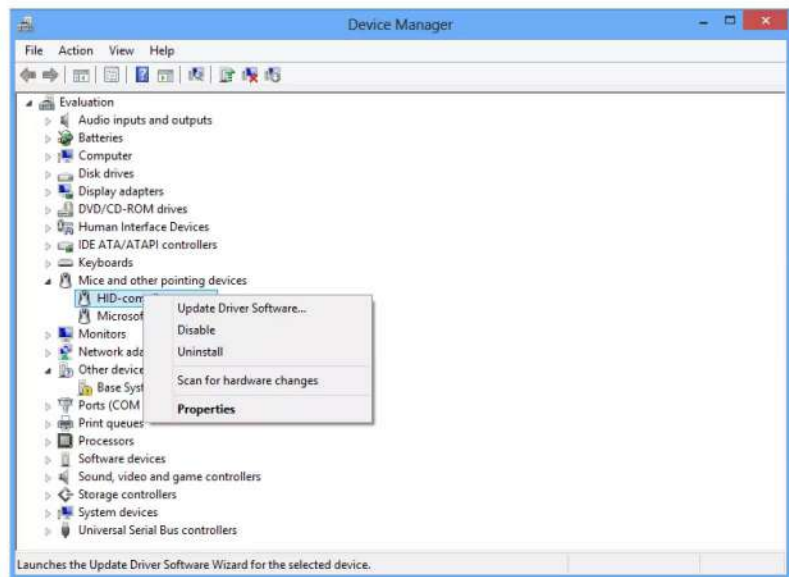
You'll spend some time staring at the Device Manager if you built your own PC and need to update your drivers manually.

and if you don't mind performing more technical gruntwork to save some cash, we explain step-by-step how to use Windows' native imaging tool in PCWorld's guide to creating a free, foolproof backup system (fave.co/3IDHya7).

Use *something*, though. Regular backups are your data's only savior if disaster strikes.

OPTIONAL: UPDATE YOUR NEW PC'S DRIVERS

This step isn't for everyone. Few things can introduce troublesome ghosts in your machine faster than a driver that refuses to play nice for whatever reason. If your from-the-box desktop PC is working fine and you only ever plan to perform basic tasks like surfing the web, working with Office, and

stuff like that, feel free to forget your computer even has drivers and keep on keeping on. Windows Update should've snagged reasonably new drivers for your hardware anyway.

But if you cobbled together a DIY rig or are rocking a gaming machine, it's a good idea to see if newer drivers are available for your hardware. Windows Update isn't always on the bleeding edge of driver updates, and new drivers for, say, your motherboard or Wi-Fi card can provide beneficial feature and performance updates. Gamers will need to update their graphics card drivers fairly often to ensure optimal performance in the newest games. (Fortunately, you can do that easily using Nvidia (fave.co/3S2g5Fr) and AMD's (fave.co/3vz1VnH) must-have graphics suites, and they'll let you know when new ones are available.)

PCWorld's guide to updating your Windows drivers (fave.co/4256tyf) has all the info you need to proceed. It was written for Windows 8, but if you search for Device Manager in Windows 10 or 11, all of the same steps outlined in the article still apply. If a driver does somehow manage to bork your PC, there's not need to fear the worst, as Windows automatically creates a System Restore Point (fave.co/42h5uLL) when you install new device drivers.

And if true disaster strikes in some bizarre, extreme case, you've got the backup image you've created—right?

OPTIONAL: LEARN ABOUT YOUR NEW COMPUTER

Now that all the hard work is done, take time to learn all the nooks and crannies of Windows—there's an awful lot of surprisingly powerful, downright *helpful* tools and tricks hidden in its depths.

Check out PCWorld's guide to the best Windows 10 tips, tools, and tricks (fave. co/3RVgLfM). You'll pick up a lot of great knowledge. We've also got a roundup of Windows 11's best hidden features (fave. co/3CmzYiX), how to make Windows 11 look like Windows 10 (fave.co/3G1SpdZ), and how to fix Windows 11's worst annoyances (fave.co/3MKARbu). And regardless of which version of the operating system you use, this guide to 10 little-known Windows features that will blow your mind (fave. co/3JYlr1H) is worth a read.

WRAP-UP

At this point you're pretty much ready to roll. Sure, there are some other tasks you should perform, such as moving over files from your old PC and saving the product keys for Windows and your other installed software (again, Belarc Advisor [fave.co/3TZSpEg] rocks for that), but you can do all that at your leisure. For now, just bask in the glory of owning a new PC, secure in the knowledge that it's fully optimized, protected against attack, and recoverable if disaster strikes.

Enjoy. ⏻

10 extensions that turbocharge Windows Explorer

Windows Explorer is far from a perfect program. **BY ROLAND FREIST**
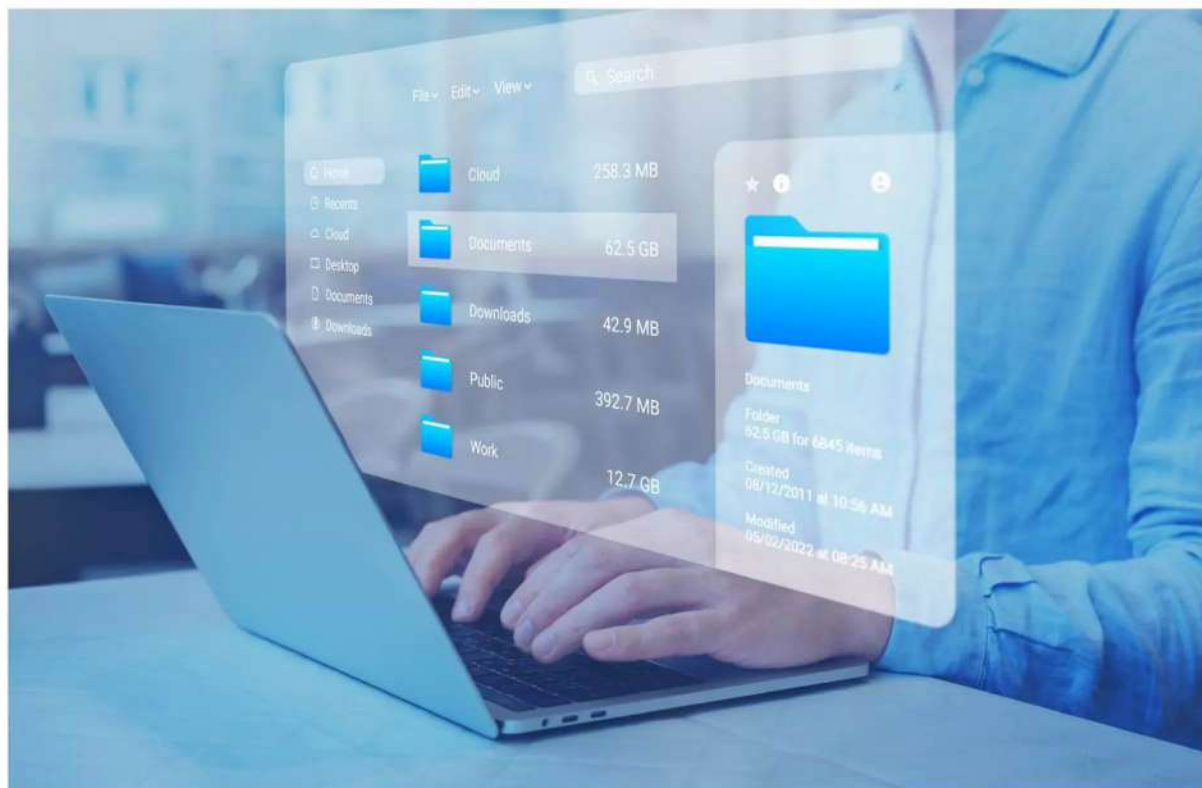
The File Explorer is one of the central tools in Windows. This is because the operating system is file orientated, so the folder in which a file is stored, its name, and extension play a major role. Copying, moving, renaming, and deleting files as well as searching for one or more files is a routine activity for every Windows user.

Although Explorer can fulfill all these tasks, it only offers a rather cumbersome way of working. Third-party manufacturers are constantly showing how it can be done better with their tools. This applies, for example, to the large, alternative file managers such as Total Commander (fave.co/48VJ30B) or Free Commander (fave.co/3Sodo2x), which work with a two-window technique, but also applies

to various smaller tools that supplement the functions of Explorer or replace them with better versions. In this article, we present a selection of these programs.

COPY AND MOVE FASTER WITH TERACOPY

If you set Explorer the task of copying or moving large volumes of data, the program first starts to think. It can take several seconds for the file manager to estimate how large the volume of data is and how much time it will need for the process, information that's usually of no interest to the user.

Teracopy (fave.co/3TYqRza) gets to work more quickly in such cases. The free tool starts working immediately after selecting the files and the source and destination folders. It offers checksums to ensure the integrity of the files and integrates itself into the Explorer context menu. All you need to do is right-click on a folder or file to define it as the source.

If you wish, you can also set Teracopy as the default program for copy actions. And unlike Explorer, the tool does not completely cancel the copying process if a file is corrupt or inaccessible, but instead simply skips it.

CHANGE FILE FORMATS QUICKLY WITH FILE CONVERTER

A major shortcoming of Windows is that the operating system itself is not able to convert files from one format to another. Instead, you have to open a suitable application each time, load the file, and then save it again in the new format.

There's an easier way, as the open-source software File Converter (fave.co/48wqiRw) proves. The tool recognizes several dozen audio, video, and document formats and converts them at the touch of a button. It integrates itself into the context menu of the Explorer so that you can start the conversion directly after right-clicking on a file. You can almost always set different quality levels, especially for audio and video files.
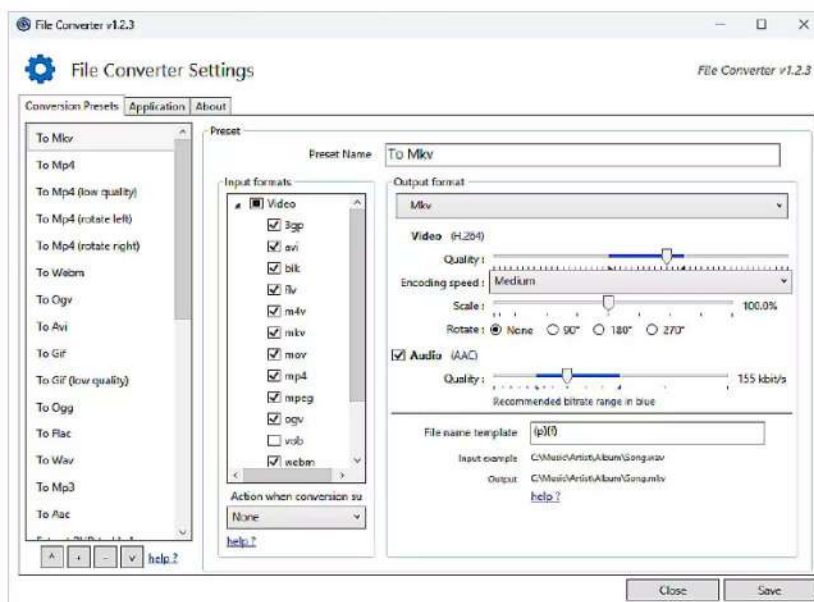
The free File Converter offers fast conversions of many file formats.

Unfortunately, the File Converter does not support export to Microsoft Office formats such as DOCX or XLSX.
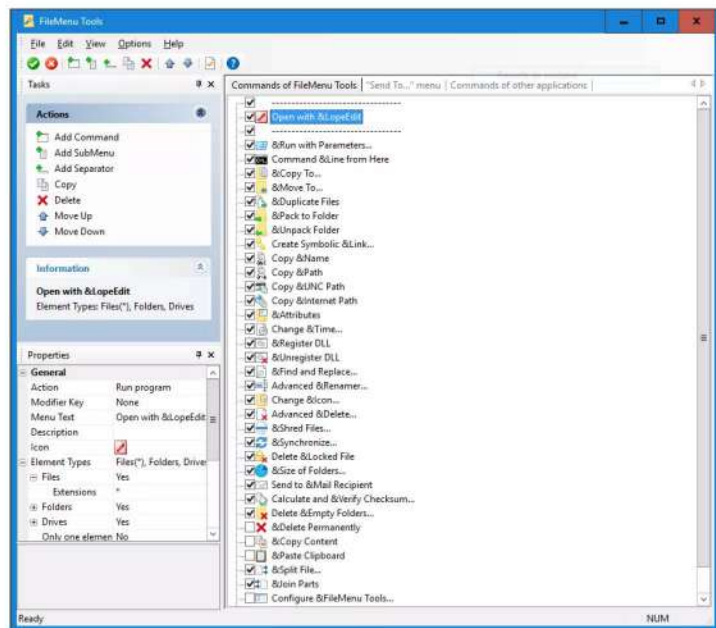
TIDY UP THE CONTEXT MENU WITH FILEMENU TOOLS

Over time, a number of commands accumulate in the Explorer context menu that you don't actually need anymore. On the other hand, it would be practical if some functions were quickly available there after a right-click. The free Filemenu Tools (fave.co/3U45DQC) allows you to reorganize this.

The program lets you edit the commands of the corresponding context menu and delete superfluous entries in its main window via the "Send to menu" tab. Here, for example, you will often find the entry "Bluetooth device," even though the computer does not have a Bluetooth adapter.

You can configure the Filemenu Tools folder in the context menu via the "Filemenu Tools commands" tab. It contains several dozen useful commands for file actions in Windows. You can remove individual commands from the list or move them. The changes take effect after a Windows restart.

Please note: Although the free version of the program allows you to edit the command syntax, you will no longer be able

Filemenu Tools not only lets you tidy up the "Send to" menu in Windows Explorer, but also adds dozens of practical commands to the Explorer context menu.

to execute the command in question if you are using this version.

There is a small additional function under Extras and Settings. Here you can replace the Windows 11 context menu with the classic form.

WORKING WITH TABS IN EXPLORER VIA QTTABBAR

You can open as many tabs as you like in your browser to quickly access multiple websites. With Qttabbar (fave.co/4b43RVx), this also works in Explorer. After installation, an additional bar appears in which you can open further tabs by clicking on a plus sign (+). The tabs can be moved and grouped together using the drag-and-drop function.

In addition, a multi-window display can be realized in Explorer in this way, which allows simple copy and move actions. Drag and drop is also supported here. The tool therefore goes far beyond what Explorer offers in Windows 11 with its tabs.

SEARCH FOR FILES BETTER AND FASTER WITH LISTARY

Explorer's search function is very powerful, but at the same time quite cumbersome to use. A good replacement is Listary (fave. co/3vEDjKm), a tool that sits in the taskbar corner and at first glance consists of nothing more than a search field.

However, the software is actually extremely powerful. On one hand, it offers a local search function. Enter the name of a file or folder, and Listary will immediately show you a list of possible locations. If you place a *g*

Listary provides Windows with a fast file search. You can use the software's commands to select search engines and internet services.

in front of the search term, the tool forwards the search to Google. With Bing, you can access the Microsoft search engine. However, you can also search in X (formerly Twitter), Bing, or Amazon, for example.

However, Listary only searches for the names of files or folders, it does not create an index for file contents. This task is still reserved for Explorer.

Professional tricks: "How to find any file on your PC in a flash" (fave.co/3vy8JSq).

SORT FILES QUICKLY AND CLEARLY WITH DROPIT

Many file actions are repeated over and over again. For example, you want to copy JPG files to your photo collection, move MP3 files to your music collection, or transfer XLSX files to other spreadsheets. With Dropit (fave.co/3S0lhK2), these processes can be largely automated.

The tool displays an icon on the desktop with an arrow pointing downward. Now open Explorer, select a large number of files, and drag and drop them onto the icon. Dropit will now carry out the associated action for each file type: for example, copying all MP3s to the music folder and copying the JPGs to the photos.

You can freely select the actions and the target folder for each type; in addition to copy actions, commands for compressing,
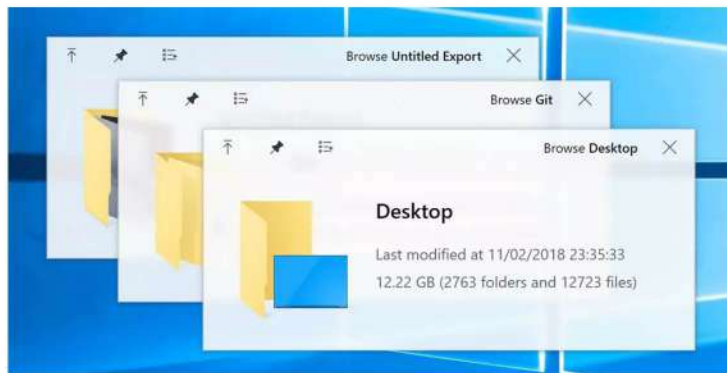
encrypting and unpacking, for FTP uploads or for sending by e-mail are also available, for example.

START PREVIEW WITH SPACE BAR VIA QUICKLOOK

On Apple computers, this is the standard procedure for quickly viewing a file. You select the file, press the space bar, and a preview opens. Explorer also offers a preview, which you can switch on under Show Preview window. However, it is limited by the window of the file manager.

The function is better solved with the open source tool Quicklook (fave.co/41YNQMx). It adopts Apple's operation and opens a separate window when you press the space bar. You can zoom in and out using the mouse wheel, and the tool also offers to open the file in the assigned application or in another application. However, Explorer is better in one respect. It also displays the

contents of Microsoft Office documents, where Quicklook has to fit. The tool can handle numerous audio, image, video, and other text formats.

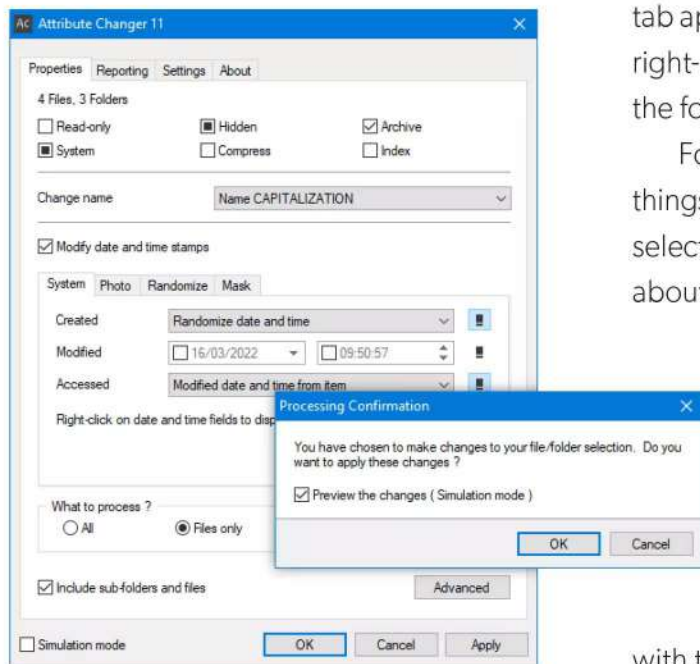## CONVENIENTLY CHANGE FILE ATTRIBUTES WITH ATTRIBUTE CHANGER

Attribute Changer specializes in editing attributes such as Read-only, Hidden, or System for files and folders. The free program is clearer than the corresponding function in Explorer and can also change the values for the creation and modification date as well as the date of last access. It is therefore an addition to backup software that uses this data as a basis for backups.

LINK FILES CLEVERLY WITH LINK SHELL EXTENSION

Link Shell Extension (fave.co/3HmZqYf) provides a command-line function with a graphical interface. You can create hard links in Windows that allow you to permanently distribute an original file to multiple storage locations. However, the operating system itself only offers this function in the command prompt or Powershell, so it requires you to do some typing.

The Link Shell Extension, on the other hand, integrates itself into the context menu of the

Quicklook brings a Mac function to the PC: After you press the space bar, the tool displays an enlarged preview of an image file. Additional information can be displayed if required.

Attribute Changer displays the attributes of a file and lets you edit them. The tool can also change the creation, modification, and last access date.

Explorer and allows you to select the original file from there and create a soft (symbolic) or hard link in a freely selectable, different folder. (Read on to find out exactly what a hard link and a soft link are. Further information can be found here [fave.co/48VTn8H]).

READING DRIVE INFORMATION WITH PROPERTY EDITOR

Explorer shows you some data about a file, folder, or drive via the Properties entry in the context menu. Once you have installed the Property Editor (fave.co/3vGm7UQ), a new

tab appears in Properties, which, after you right-click on a drive, lists the data volume of the folders it contains.

For files, the tool offers, among other things, to set up a hard link to a freely selectable folder and provides information about the attributes.

WHAT ARE SOFT AND HARD LINKS?

You often create a shortcut to a file on the desktop to access it more quickly. This link is actually a link that is saved in the form of a small file with the extension LNK in this case in the desktop folder. This is called a *soft link* or symbolic link.

There are also *hard links*. While a soft link refers to an original file, a hard link is a link from the original file to a placeholder in another folder. This is not a copy but, like a soft link, a small file with meta information. The difference: If you delete the original file with a soft link, the link leads nowhere, and Windows displays an error message after a double-click. With a hard link, on the other hand, the original is retained as long as there are still placeholders in other folders.

Hard links are a feature of the NTFS file system and are practical for compiling backups or collections of files on individual topics, for example. In Windows itself, they can only be created via the command prompt or Powershell. ⏻
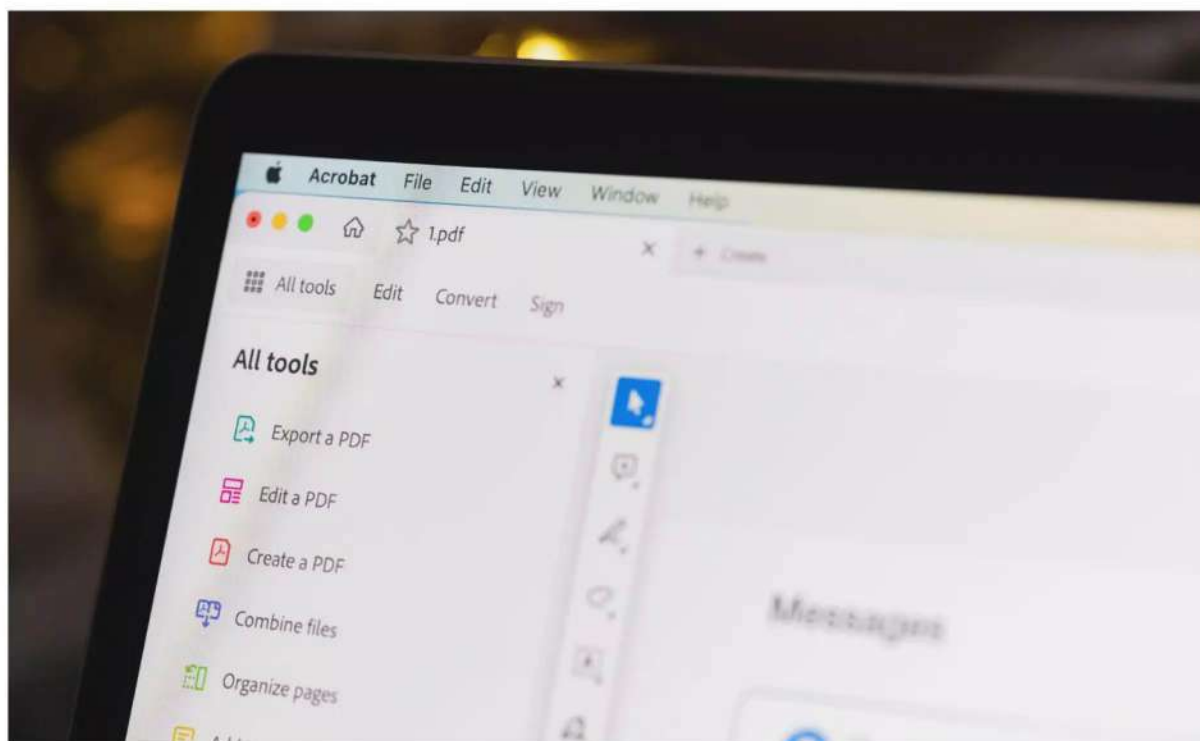
How to edit PDF files

Need to make notes in a PDF, or perhaps correct a few typos or reorganize the pages? Here are the tools and tips you need. **BY ANDERS LUNDBERG**

Editing PDFs is something many people need to do, but unfortunately it's not always the easiest thing to manage. The format is not designed to be easily edited, and despite a plethora of Windows and web apps, there is no universal solution beyond Adobe's expensive Acrobat Pro.

LABELING PDFS

Labeling is probably the most common way to edit PDFs. Many times when sharing a PDF file with someone else, you may need to draw attention to something by crossing it out with a "marker," adding a comment, or drawing something in the document.

This type of editing is included in many PDF programs that do not have other forms of editing. Both Adobe's otherwise very limited Acrobat Reader DC (fave.co/3VdGoYY) and popular third-party applications like Foxit and Sumatra PDF support labeling and annotation. Full-fledged editors like PDFgear, PDF-Xchange (fave.co/48Udl3R), and Adobe Acrobat Pro

(fave.co/3VdGoYY) also have it, but so does the built-in PDF reader in Microsoft Edge.

Annotations and labeling are part of the PDF format and are saved separately from the content of the document. This means markups you have made in one program will also appear in other programs but may look different. Lines, geometric shapes, and freeform shapes you have drawn should look more or less the same, but even here there may be slight differences. So unless you save a screenshot of how it looks on your end, you can't expect labeled PDFs to look exactly the same to the recipient.

Here are the different tools you can use:

Text marking—coloring, crossing out, or underlining

In some applications, you first select a piece of text and then click on, for example, coloring. In others, you select the tool first and then select the piece of text to be changed. In both cases, the text is colored or underlined or struck through.

Graphic shapes—drawing with different geometric shapes

Draw in arrows, ovals, rectangles, rounded rectangles, lines, and other shapes.

Draw freely—best with a pencil or touch screen

If the ready-made shapes are not enough, you can use drawing tools and draw by hand with a mouse, tablet, or pencil if you have one.

Text

You can also add text on top of the content and change the font, size, and style of the text. This can be used, for example, to fill in a form that has not been made truly fillable.

Annotations

An annotation is not a piece of text you have added on top of the regular content of the PDF, but a special type of content placed at a point on the page, linked to a piece of text that can be displayed in different ways in different programs. Often you can see notes both in a box next to this point (click to show or hide) and in a list of notes alongside the content itself. It works much like comments in Word.

Reordering, deleting, and rotating pages

Reorganizing and removing unnecessary pages in a PDF is also a common task. For example, a document you often print and you don't want to select pages every time, or a scanned book where some pages are in the wrong order and you want to avoid confusion.

A related problem is documents where individual pages—or all of them—are in the wrong order. Typically, scanned documents are printed in landscape mode, where you normally just turn the document and read the page. On a computer, this is not as easy, so it makes more sense to rotate the pages of the
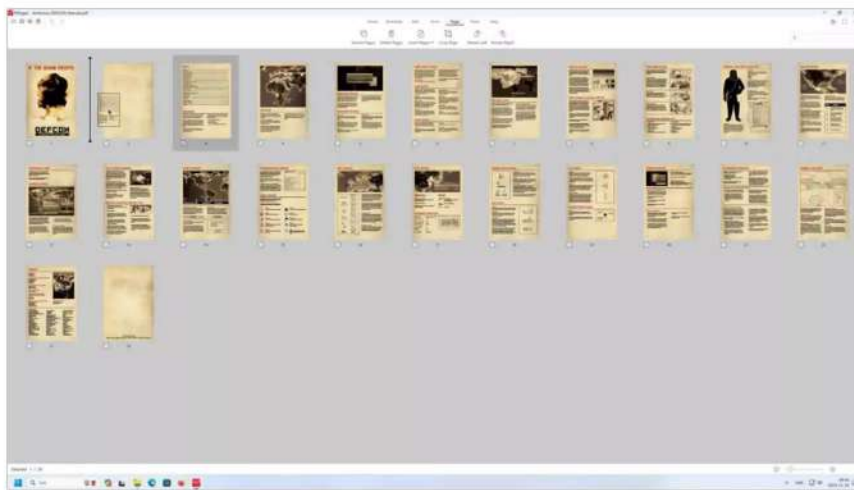
Moving pages.

PDF so that the text and other content is in the right place to read.

Deleting individual pages is also something you may need to do, and is possible in most programs that can also rotate and move pages.

Here's how to move pages in PDFgear. It may work similarly in other programs, but also slightly differently, so check the documentation or help pages if you have a different program.

1. Click on the tab Page.

2. Click on one or more pages to select them.

3. Drag and drop to move the selected pages. The program clearly shows how they will be placed.

4. Click OK when the program asks if you really want to move them.

To delete pages, select them and click on Delete Pages in the toolbar. Rotate works the

same way, with two buttons to rotate either left or right.

If you don't want to install a program in Windows, you can try the web tool Simple PDF (fave.co/ 47FAhCW), which doesn't upload the files but does all the work directly in the browser on your computer. To move a page here, use the up- and down-arrow buttons next to the thumbnails in the page list on the left. Unfortunately, you can only move one page at a time, so if you need to reorganize your document, this is not the most practical solution.

Simple PDF also has buttons next to the thumbnails for deleting and rotating pages. This also applies to each page individually, and there are no functions for selecting and working with multiple pages at a time.

MERGING PDF FILES

Want to combine the content from several PDF files into one? This can be useful, for example, to collect all the invoices from a company in one file, merge two files to be printed together, or insert a scanned copy of a signed contract into the original PDF.

Of the free programs I've tried, PDFgear (fave.co/3TknKkB) has the easiest tool for

this, while Apple's Preview is much easier for Mac users. Online tools such as Acrobat Online and ilovepdf.com can work okay, but they sometimes put the pages in the wrong order and you can't easily select only certain pages from one file to add to another.

In PDFgear, open the first file and click on Page tab. Then select Insert Pages > Insert PDF (you can also choose to import from Word or an image, or add a blank page to make the document print correctly double-sided or with two pages per sheet). Once you have selected a file, a dialog box appears where you can already choose which pages to insert. You can mix ranges and single pages—for example "1,2,5-8,12" to insert pages 1, 2, 5, 6, 7, 8 and 12. Here you also choose where in the document the new

pages should be placed—first, last, or before or after the selected page.

Once the pages are inserted, you can move them as usual (see above).

CONVERTING PDF TO PLAIN TEXT (AND COMMON PROBLEMS)

With other file formats that have text, it is usually easy to copy or export the content to plain text—for example, to quote it in another text. This is not the case with PDF. Seemingly simple things like highlighting a line of text can be almost impossible, as the PDF viewer gets the idea that the text is actually two columns, and when you pass a certain point, the entire left "column" is suddenly highlighted.

Even when it understands that all the text is part of a text block and should be highlighted line by line, there can be errors. When you paste the copied text, it often has line or paragraph breaks after every other line, so that a paragraph does not behave at all like a paragraph in Word or other word processors.
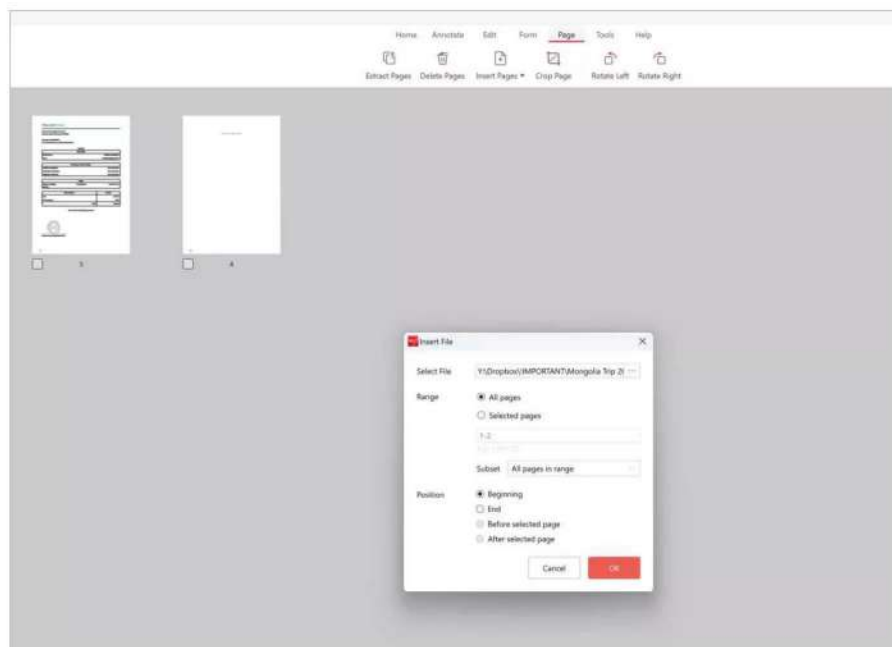
Merge PDFs.

This problem has been around for many years and for some reason has still not been fixed by any developer, even though it has worked in Apple's Preview since Mac OS X was released in 2001. Neither Adobe, Foxit, PDFgear, Microsoft Edge, nor Firefox can handle it.

I have tried a number of methods to fix this, and found two that work relatively well in most cases. For single paragraphs, by far the easiest is to copy and paste into a browser's address bar, then select everything and copy again. The address bar automatically removes all line breaks so the result is a single piece of clean text with no formatting.

1. Copy and paste the text into Word or another word processor, with all unnecessary paragraph breaks.

2. Find and replace double paragraph breaks with a special character or a small text string that does not appear at all in the text, such as #@#.

3. Search and replace single paragraph breaks with spaces.

4. Find and replace the #$# placeholder (or whatever you chose in step 2) with a single paragraph break.

You can copy a paragraph mark by clicking the paragraph mark button in the Home tab and then selecting one from the text.

For full pages or documents, I recommend trying one of the many pdf-to-docx converters available on Acrobat Online, for example, and copying from the resulting Word file. It usually works, but not always. Using a search-and-replace function to remove line or paragraph breaks can also work, but of course that also removes paragraph breaks that should be there.

PDF files that are not text but scanned images must first be OCR scanned before you can copy any text. Some PDF readers can do this automatically as you read, but you can also use a program that scans the whole document at once and converts it to text. This can be
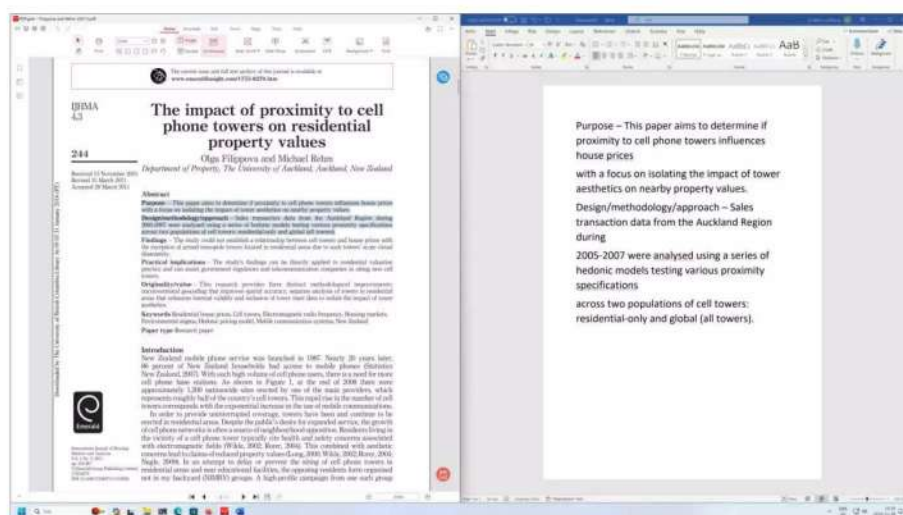

Something as simple as copying a few paragraphs of text and pasting it into another program can cause problems if the source is a PDF.

done with various online tools or installed programs such as PDFgear.

ADVANCED PDF EDITING—CHANGING TEXT AND IMAGES

The PDF format was not designed to be editable. The content is not neatly organized, and PDF editors have to carefully make changes to the code so as not to ruin the layout when changing text and other elements. But where there is a need, there are usually solutions, and there are now a number of programs that allow you to make changes to text, images, and other things in existing files.

Really small changes, such as correcting spelling mistakes, usually go without a problem, but with larger changes, the rest of the document can still get messed up. So it's best to always edit a copy of the file and make changes step by step.

Of the free programs I have tested, PDFgear is the best in this area too. The only major shortcoming of the program is that it is not possible to edit existing images. You can replace
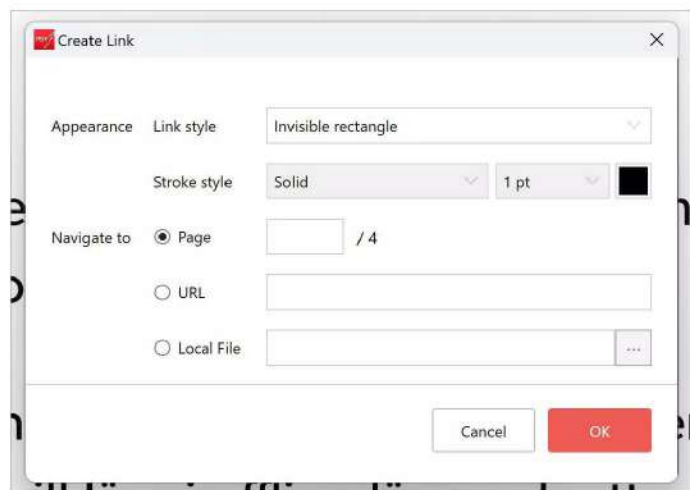
Inserting links in PDF files.

an image by inserting a new image and placing it over the old one, but you cannot, for example, resize or delete an image. This is something Acrobat Pro and some other paid programs can do.

In PDFgear you will find the editing functions in the tab Edit tab. Of course, to edit text you use Edit Text. Add Text and Add Image add new text and images, of course. Link-function is interesting. It allows you to draw a rectangle, which then becomes a link.

Create fillable PDF forms.

The rectangle can be visible or invisible and the link can go either to another page in the document (useful if you have a book with a table of contents that was not created with links, for example) or to a URL.

Edit Object-function works on editable objects that also include some non-text elements, but as I said, I can't change images and I haven't found any other graphical elements that can be edited. The developers of the program have promised better support for editing in the future, so hopefully the need for paid programs will decrease.

I haven't found any free software for Windows that can remove or replace existing images, but there is an online tool that seems to work pretty well: Xara (fave. co/3Hox1B0). You have to create an account, but all PDF editing is included in the free version. Xara also looks like it's probably decent for editing text and other things, so it could be a reasonable alternative to PDFgear and paid software.

CREATING FORMS FOR OTHERS TO FILL IN

Finally, we come to an area where Adobe's Acrobat Pro is king, but where there are decent third-party solutions these days: turning flat PDFs into fillable forms. You've probably filled one out yourself at some point and appreciated how much easier it is than manually adding text or printing and filling it out by hand.

There are some alternatives, both paid programs that are cheaper than Acrobat Pro and web-based services. One example I find works well is the free service Sejda (fave. co/3Sn6Dht). It allows you to add text fields, checkboxes, and multiple-choice menus. Text you enter in text fields can be removed when the file is filled in and can thus be used to give instructions on how to fill in the field without having to leave space for it outside the field. ⏻
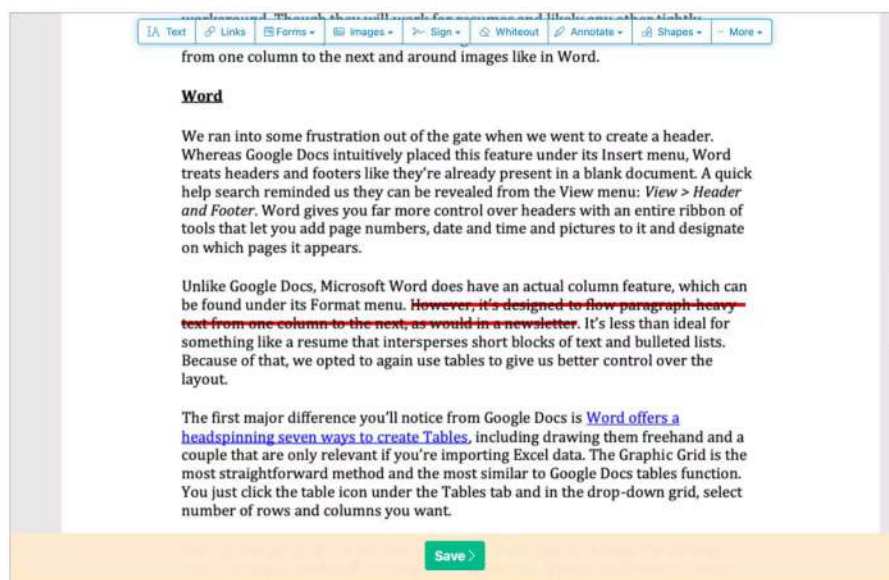
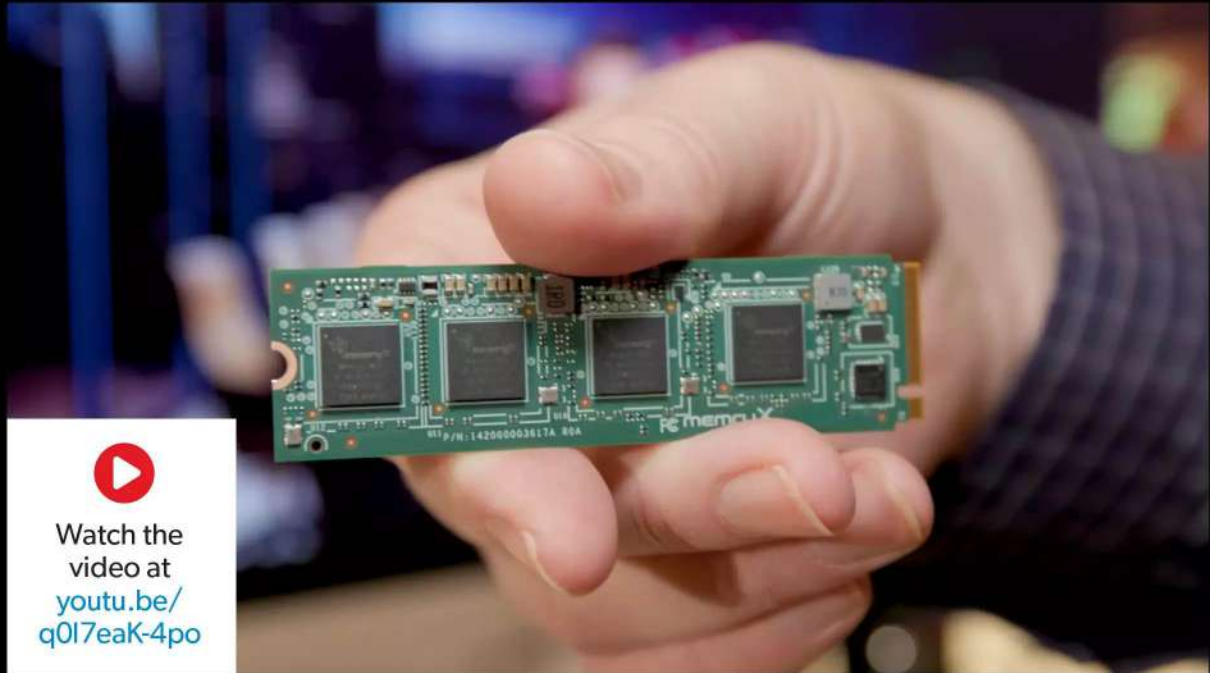**Sejda's editing interface is simple and intuitive to use.**

Smokey Bear is within us all.

For wildfire prevention tips, visit
SmokeyBear.com

Tech Spotlight

A video showcase of the latest trends

Watch the video at youtu.be/ q0I7eaK-4po

These AI Accelerator Cards Hope To Be The Next 3dfx

⟶ AI was a huge topic at CES 2024, and there is a crop of companies showing off desktop-based accelerator solutions that hope to make huge waves in the market - ala 3dfx video accelerators back in the day.