INSIDE: DON'T FALL INTO THE FREE CLOUD STORAGE TRAP

PCWorld

APRIL 2022

WI-FI 7 IS COMING

MEET THE SMARTER, FASTER INTERNET OF THE FUTURE

PLUS: ASUS ROG ZEPHYRUS G14 (2022) REVIEW


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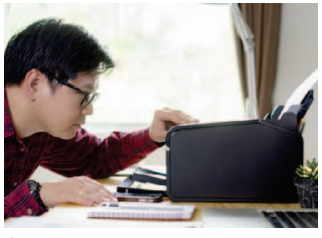

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>> How a silver lining forms

>> It starts at sea.
>> Tropical waters heat up.
>> Warm air soars skyward.
>> Cold air rushes to the void.
>> Cold air warms up.
>> Cycle repeats.
>> Faster and faster—a 50,000 foot engine of air.
>> At seventy four miles per hour it earns a name.
>> Harvey, Irma, Katrina.
>> Then landfall.
>> Roads rendered useless.
>> Buildings destroyed.
>> Families stranded.
>> But for a brief moment,
>> A silver lining appears.
>> People see neighbors instead of strangers.
>> And labels that divide are forgotten.

>> But when rains ease,
>> when clouds part,
>> silver linings need not fade.

>> Let's embrace our shared humanity.
>> Let's connect with one another.
>> Let's find our love for each other.
>> Every single day.

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Wi-Fi 7 is coming: Meet the smarter, faster Internet of the future

Wi-Fi 7 will be a key feature of Qualcomm's new Snapdragon Connect premium brand.

BY MARK HACHMAN

Move over, Wi-Fi 6E! Chip vendors like Qualcomm are making plans for Wi-Fi 7, the next generation of Wi-Fi technology. Qualcomm said at Mobile World Congress 2022 that it plans to launch the world's first Wi-Fi 7 chip, the FastConnect 7800, as part of its new premium Snapdragon Connect specification by the end of 2022.

The Wi-Fi 7 specification, also known as 802.11be Extremely High Throughput (or just 802.11be), isn't even close to being completed — the IEEE's current paper (fave.co/3iejxeK) on the current status of 802.11be calls for the standard's ratification sometime in 2024. But as with previous Wi-Fi standards, that isn't stopping vendors from developing silicon based upon draft releases, tweaking them via firmware or other updates as the specification moves through its final approval process.

Yes, Wi-Fi 7 will be faster, in part because of wider channel widths. But the key

IMAGE: ALEJANDRO BARBA/UNSPLASH

improvement Wi-Fi 7 makes is how it smartly uses what earlier Wi-Fi versions have already provided it.

WHAT IS WI-FI 7? THE SHORT ANSWER

Wi-Fi 7 will significantly increase Wi-Fi bandwidth. How much? According to the IEEE, the maximum nominal throughout of Wi-Fi 7 is 46Gbit/s, 4.8 times faster than Wi-Fi 6 and slightly faster than the 40Gbits/s throughput delivered by a Thunderbolt 3/4 connection.

In the real world, though, the numbers will be lower. According to Mike Roberts, the global vice president for product marketing at Qualcomm, the FastConnect 7800 will reach real-world throughput speeds of 5.8 gigabits per second, 60 percent more than the previous (Wi-Fi 6E) generation. The average latency will be less than 2 milliseconds, or 60 percent faster than the previous generation, he said. Mediatek, which also recently demonstrated Wi-Fi 7 in action, claims that it's 2.4 times faster than Wi-Fi 6 (fave.co/3KQFJI4).

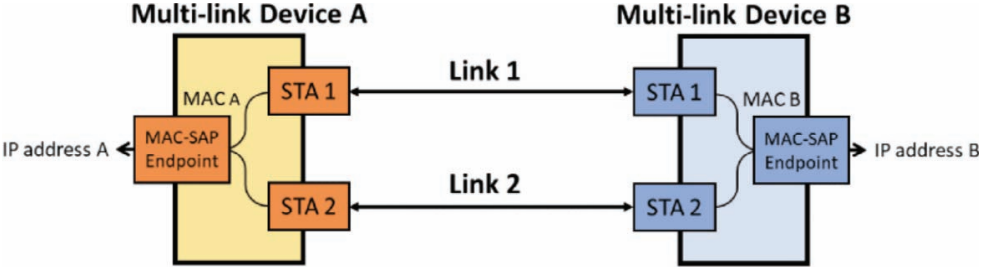
How Wi-Fi 7 improves the overall experience, however, is both cooler as well as a bit more complicated.

WI-FI 7: FASTER, SMARTER, AND WITH FAR LESS LAG

Wi-Fi 6 was optimized for congestion and wireless efficiency, enabling your router to effectively communicate with dozens of wireless devices (fave.co/3IkeCUI). Wi-Fi 6E weaved in a dedicated 6-GHz frequency, adding channels for high-bandwidth devices such as mesh routers to communicate with one another. If you think of wireless communication as lanes on a freeway, WiFi 6E effectively added a dedicated HOV or commuter lane, giving high-priority buses and ambulances their own traffic-free channel.

A Wi-Fi 6 router, such as Netgear's Orbi Tri-Band WiFi 6 Mesh System, can communicate data on the 2.4-GHz, 5-GHz, and 6-GHz channels simultaneously.

In the real world, though, cars moving down a freeway can reroute themselves to avoid congestion. Until now, Wi-Fi couldn't. A Wi-Fi 6 router can communicate data on both the 2.4-GHz, 5-GHz, and



An IEEE illustration of Wi-Fi 7's multi-link architecture (from Moon, D. Lee, Y. Noh, M. Cheong, and H. Yu, Multi-Link Operation: Design Discussion, Sep. 2019) shows how your computer will "talk" to a single Wi-Fi radio, but internally may use one, two, or both.

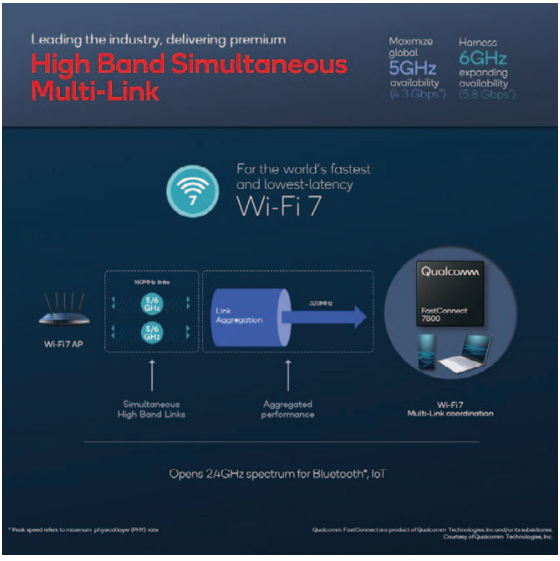
6-GHz channels simultaneously, but they're all independent of one another.

Wi-Fi 7's most significant improvement is that it transforms the router into a multi-link device. Several physical radios can communicate on separate frequencies, yet Wi-Fi 7 ties them all together underneath a single MAC interface so that an Xbox or a smart speaker sees a single device. A Wi-Fi 7 router can simply assign data packets to whatever frequency channel is the least congested, because *it simply doesn't care* which frequency it uses.

Put another way, the days of manually configuring a device to be "on" a 2.4-GHz or 5-GHz network appear to be over. Wi-Fi 7 will choose which frequency band has the lowest congestion and send the data over that channel. Qualcomm calls this Alternating Multi-Link, where devices simply switch back and forth between available bands. Bouncing back and forth between channels also has implications for power saving, according to the IEEE.

In a case where a Wi-Fi 7 router is only "talking" to another device, there's another option that Qualcomm calls "High Band Simultaneous Multi-Link." With it, *all* bands are used simultaneously to blast data across all available radio frequencies. That means what it says. Wi-Fi 7 devices won't necessarily communicate on, say, a 6-GHz channel—they'll be able to theoretically communicate on all three at once. (Practically, that won't happen; the 2.4-GHz band will continue to be reserved for slower IoT devices. In the Qualcomm FastConnect 7800, HBS Multi-Link combines four streams across the two 5- and 6-GHz radios, Qualcomm said.)

In part, this takes advantage of an additional feature: Wi-Fi 7's wide-channel spectrum use. According to Qualcomm (fave.co/3KRHDbt), Wi-Fi 7 widens the maximum available channel width from 160-MHz to 320-MHz—a wider channel band equals more available throughput.



Qualcomm Wi-Fi 7 High-Band Simultaneous Multi-Link uses all bands to simultaneously blast data across the available radio frequencies.

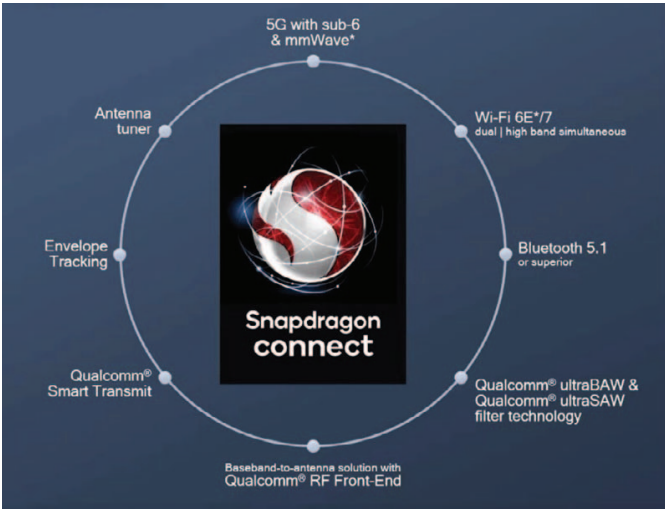
The kicker, however, is that the 320-MHz channel isn't always available. Instead, Wi-Fi 7 can combine two 160-MHz channels in the high (5- and 6-GHz) bands to create an effective 320-MHz data channel. Wi-Fi 7 can then use these channels as it chooses, such as using one radio for communicating to a device and another for receiving data. Wi-Fi 7 also incorporates "preamble puncturing," which is a more aggressive way of handling interference, according to Qualcomm. If a Wi-Fi 7 router is trying to connect to a channel that's *partially* interfered with, the router doesn't give up. Instead, it simply grabs the channel bandwidth that's not being interfered with. The upshot is that Wi-Fi 7 will more efficiently use data.

Wi-Fi 7 also includes 1024-QAM, a way of effectively increasing the throughput by increasing the number of bits communicated by the analog signal—about 25 percent more data than the 256-QAM of Wi-Fi 5, according to the IEEE.

There's one big additional benefit. From Qualcomm's perspective, a Wi-Fi 7 router that can intelligently pick channels also significantly reduces wireless latency or lag. That will be perfect for gaming or for Qualcomm's AR/VR ambitions, which demand latency-free video to prevent vertigo. We don't know how this will play out, but in a world moving to cloud gaming and VR, reduced latency may be the most significant addition of all.

SNAPDRAGON CONNECT

The Qualcomm FastConnect 7800 will be part of what Qualcomm calls Snapdragon Connect, which will be the premium brand for all of Qualcomm's connection technologies. "Devices that conform with Snapdragon Connect will ship with our best 5G, Wi-Fi, and Bluetooth," Roberts said. "This is going to enable faster, more responsive, more reliable, connected experiences. When a device has Snapdragon Connect, it will feature a comprehensive suite of our



Qualcomm's Snapdragon Connect.

technologies from our baseband to [the] antenna system."

That suite will include the Snapdragon X70, Qualcomm's newest 5G modem, which features "AI-powered optimizations of both sub-6GHz and millimeter wave links for improved speeds, coverage, mobility and link robustness," Roberts added. "The X70 inherits the 10-Gbps 5G peak download speed record from its predecessor and introduces new features such as switched uplink, enabling 3.5-Gbps peak upload speeds in more networks globally," Qualcomm said.

It will also include what Qualcomm calls "Advanced Bluetooth Audio," two radios with enhanced connections, allowing Bluetooth accessories to work with twice the range and pair in half the time.

Finally, Qualcomm also announced the Lenovo ThinkPad X13S, which will be the first to use the new Snapdragon 8cx Gen 3 (fave.co/3CQhtms). The Snapdragon Connect-qualified laptop will feature a whopping 28 hours of battery life, Roberts said.

All of these may be Qualcomm's own specific announcements, certainly. But a new generation of wireless technology that's available for all of us appears to be right over the horizon.

Lenovo's ThinkPad X13S will be the first laptop to use the new Snapdragon 8cx Gen 3.

Everything you ever wanted to know about Valve's Steam Deck

Valve's portable PC gaming powerhouse is here! **BY MICHAEL CRIDER**

Valve's Steam Deck is finally here. If you're still on the fence or wondering what all the fuss is about, we've corralled just about everything you could possibly want to know about the hottest PC game machine of 2022.

WHAT IS THE STEAM DECK?

The Steam Deck (fave.co/3HIY1Qt) is Valve's foray into the world of portable gaming, a machine broadly modeled after Nintendo's excellent Switch console design (fave.co/3wVgqPh), but running on conventional PC hardware. That means it runs a full desktop operating system and in theory can play more games than any portable game machine ever built.

This is far from the first portable game machine with full PC parts. But with Valve baking the incredibly popular Steam platform

IMAGE: VALVE

right into the hardware, and introducing it at an unprecedented low price, its introduction might just be the biggest shift in the PC gaming market in years.

HOW POWERFUL IS THE STEAM DECK?

The Steam Deck uses a custom-designed APU, a combination CPU-GPU architecture built by AMD. The CPU is the equivalent of a Zen 2 laptop processor with a 4/8 core setup of primary and secondary cores maxing out at 3.5GHz. The GPU is an integrated 8-core RDNA 2 design (fave.co/3aRUJWc), some of the same architecture used in the latest consoles like the PS5 and Radeon graphics cards (fave.co/3DOEuWk), but here implemented for operating on the low power requirements of a portable machine.

All Steam Deck units use 16GB of RAM, which isn't user replaceable. Depending on which version of the Steam Deck you buy, you'll get 64GB of eMMC storage, 256GB of faster NVMe SSD storage, or a 512GB upgrade, all coming in standard and user-replaceable m.2 modules (like some modern laptops [fave.co/2Z26gQg]). Storage can be further expanded with a mobile phone–style MicroSD card slot.

Other relevant specs include a 7-inch, 1280×800 LCD touchscreen running at 60Hz, 5Ghz Wi-Fi and Bluetooth 5.0, a standard headphone/microphone jack, and USB-C for charging and outputting video at up to 4K 120Hz. The latter will require the Steam Deck Dock, sold separately and not arriving until later this spring (fave.co/3JuQUGa). The Steam Deck is not being offered with a mobile connection option, and it has haptic trackpad feedback, but not full vibration motors.

That's a lot of specs and numbers, but how does the Steam Deck handle actual games? That's a complicated question. The short answer, at least according to initial hands-on testing, is surprisingly well. The Steam Deck handles 2D low-power games like a champ, as you might expect, but it's also surprisingly adept at the latest AAA 3D games. It can even—technically—do ray tracing, though players will probably want to turn it off for most games to avoid paying a steep performance penalty.

While it won't match the blistering graphics and speed of a full gaming desktop, it appears it can handle most brand-new games at 30 frames per second at its native screen resolution. Some, especially those that are coded to run natively on Linux, can easily hit 60fps even with graphical goodies enabled.

HOW BIG IS THE STEAM DECK?

In a word: massive. At 298x117x49mm (about 11.7x4.6x1.9 inches), the hardware absolutely dwarfs the Nintendo Switch, which is just 9.4 inches wide with approximately the same size

screen for the new OLED model. The Steam Deck is far larger than even the legendarily bulky portable machines of old, like the Sega Game Gear or the Nintendo Wii U touchscreen controller, and it's considerably bigger than other PC-based portable machines like the Aya Neo.

If you need a quick and easy size comparison, the Steam Deck is approximately two Xbox controllers wide. It is, if you'll forgive the technical industry jargon, a chunky boi.

Why is it so freakin' big? There are a few reasons. One, most of the actual power of the Steam Deck is coming from parts designed for laptops, which have limiting factors on miniaturization. Comparing them to Arm-based hardware like the Switch (which uses Nvidia chips originally designed for phones) isn't exactly fair. The Steam Deck also needs a fairly sizable battery, and enough space to keep all those components cool while you're playing.

On top of all that, the Steam Deck needs space for a ton of controls. In addition to the standard controller layout (all the stuff you'd find on an Xbox controller) and a touchscreen, it includes the same haptic touchpads previously seen on the Steam Controller (fave.co/3N0xZFc), plus two rear-mounted finger buttons on each side. It's a significant expansion of inputs versus something like the Switch.

But more interestingly, the Steam Deck hardware is also designed to be accessible, upgradable, and repairable by the user. In a first for a mainstream portable game machine, Valve is encouraging users to upgrade the storage if it suits their fancy, and will be providing repair parts to iFixit for direct sale to consumers (fave.co/3N10faV). Valve even published its own teardown video (fave.co/3qpLrZB)!

That kind of hardware flexibility is encouraging, and we'll probably be seeing a ton of fascinating user modifications to the Steam Deck.

HOW LONG DOES THE STEAM DECK BATTERY LAST?

It depends. Valve claims that the Steam Deck's built-in 40-watt battery can run for "2–8 hours of gameplay." Obviously battery life is extremely variable for any kind of

portable device.

Initial hands-on testing of the Steam Deck (fave.co/3LRg0Rd) shows that Valve's prediction is broadly accurate. Intense 3D games can run a full battery down in as little as 90 minutes, with most games seeing between three and six hours of playback time. Adjusting variables, like less intense graphics settings and lower brightness, will extend the battery life. The Steam Deck comes with a 45-watt USB-C charger, and needs about three hours (without playing) for a full recharge.

HOW DOES THE STEAM DECK CONTROL MOUSE AND KEYBOARD GAMES?

We mentioned all the extra space in the Steam Deck dedicated to controls, notably an ultra-sensitive haptic trackpad for each of the user's thumbs. The hardware also has gyroscopic controls, allowing the player to move the unit itself to aid in things like aiming or steering. Valve has been refining its methods for controlling PC games with console-style hardware inputs for the better part of a decade; a lot of the design work that went into the Steam Controller has been refined and improved for the Steam Deck.

All that being said, we'd be lying if we told you that controlling a game designed exclusively for mouse and keyboard with controller inputs and touchpads is simple. Most major titles have (or will have) controls provided for by either Valve or the developers themselves. But "pure" PC games, and those that don't have a console-style control setup, will benefit from some experimentation and tweaking by the user.

Fortunately, Steam's interface and control options are incredibly refined and user-customizable (fave.co/3CXstOW). And even if you don't feel like diving in and tweaking a hundred different variables yourself, Steam has access to a database of control schemes for each game, customized and shared by a community of players.

The device includes two ultra-sensitive haptic trackpads.

WHICH STEAM GAMES CAN THE STEAM DECK PLAY?

The Steam Deck runs SteamOS out of the box, a Linux-based operating system customized and maintained by Valve. It can run more or less any game with a

Linux version without issue.

Of course, even with several years of progress, the Linux gaming scene is still a long way behind Windows. For games without a native Linux version, the Steam Deck uses the open source Proton compatibility layer (fave.co/3l79xPR), and it will be the true test of whether the handheld sinks or swims. Proton allows the Steam Deck to run Windows games without needing the full Windows operating system. It's based on Wine (Wine Is Not an Emulator) and tweaked by Valve and Codeweavers for gaming performance.

But back to that core question: Which Steam games, and specifically which Windows games, can the Steam Deck run? The answer is, apparently, most of them. Even games requiring the Proton compatibility layer are running surprisingly well on the Steam Deck hardware.

Valve is testing its library of games on the Steam Deck to see which can run on it. The company has published a tool to let you see which of the games in your library run (fave.co/3qol9qB) without any tweaks needed (Verified), which will need some graphics and/or control settings (Playable), and which just won't run (Unsupported). You can log in with your Steam account to check the titles in your library.

Of course, with tens of thousands of games on the Steam platform, even Valve can't test them all right away. The company is focusing on the most popular titles at the moment. A semi-random selection of Steam games (my library) showed 45 games as Steam Deck Verified, 27 as Steam Deck Playable, and 11 games as Unsupported, with a whopping 245 games untested at the time of writing. Assuming that the ratio stays steady for my entire library—a big assumption, admittedly—approximately 85% of my current games should be playable on the portable hardware.

Valve is testing its library of games on the Steam Deck to see which can run on it.

CAN THE STEAM DECK RUN WINDOWS?

Yes! Technically. While the Steam Deck's hardware is designed to run SteamOS for both its base software and its interface, it's an open platform, and Valve will allow users to install Windows (or other operating systems) if they want. Dual-boot configurations might be trickier, but will still be possible.

That might not be the best idea, however. Without the custom integration of hardware and software

You'll be able to run Windows on the device.

from Valve, the Steam Deck running Windows will certainly suffer from poorer performance and battery life. It might also have other issues, like outputting video and audio via generic drivers. That might be worth it for players who want access to the full gamut of games available for Windows.

CAN THE STEAM DECK PLAY NON-STEAM GAMES LIKE *FORTNITE*?

Yes and no. The Linux-based SteamOS supports installing any Linux software, including Linux-based alternative game launchers like Itch.io or Lutris. So if a game offers a Linux version, the Steam Deck can handle it.

However, running games designed for Windows that don't integrate with the Steam store and software, like Epic's *Fortnite*, Blizzard's *World of Warcraft*, or the Windows-based Xbox Game Pass, will present multiple layers of hurdles. It might technically be possible, but prepare for a lot of potential problems. Companies that compete with Valve and Steam aren't going to bend over backwards to support the Steam Deck: Epic has already said it won't build a version of *Fortnite* for the portable machine (fave.co/3L3Q57I).

The nuclear option in terms of game support is, of course, to get around the Linux-based SteamOS and install Windows—see the previous section.

CAN THE STEAM DECK STREAM GAMES LIKE XBOX GAME PASS?

Yes! In addition to streaming games from your gaming PC using Valve's Steam Link system, either locally or with Remote Play. With the Steam Deck's built-in browser, game-streaming services like Xbox Game Pass Cloud Gaming, Nvidia GeForce Now, and Google Stadia *should* run right out of the box.

CAN THE STEAM DECK RUN EMULATORS?

Yes! The Steam Deck will run any emulator with a Linux version (like Dolphin) natively, and emulators designed to run on Windows can run via Proton. With Proton, emulating older 2D console games shouldn't be an issue, but running an emulator through a compatibility layer might present significant slowdowns for 3D console games.

HOW MUCH DOES THE STEAM DECK COST?

The Steam Deck comes in three price tiers (fave.co/3HIY1Qt), with the only major difference being storage. It's surprisingly affordable, starting at just $400—less than half the price of other PC-based portable machines.

Steam Deck 64GB: $399; eMMC-based storage, comes with a carrying case

Steam Deck 256GB: $529; faster NVMe SSD storage, carrying case, and extra digital goodies for your Steam profile

Steam Deck 512GB: $649; even faster storage, upgraded anti-scratch glass screen, deluxe carrying case, and more digital Steam goods

Remember when making your choice that you can upgrade the storage yourself with a standard M.2 SSD drive in the 2230 size, though that SSD form factor can be difficult to find in standalone form.

The Steam Deck launched February 25—sort of.

WHEN CAN I GET A STEAM DECK?

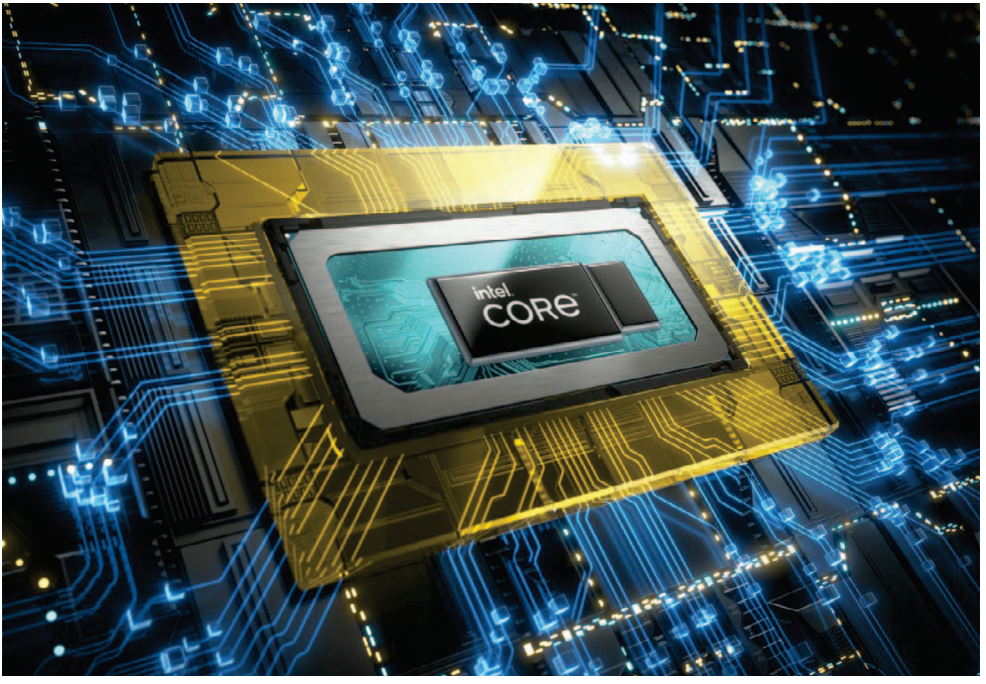
The Steam Deck technically launched on February 25, sort of. That's when those who had reserved the hardware previously had the opportunity to start buying it, with three days to make a decision. The Steam Deck started arriving in the hands of players on February 28, with the usual shipping variables in effect.

Here's the real bummer: Valve started accepting pre-orders for the Steam Deck right after it was announced, in July of last year. So the earliest reserves for buying the hardware were sent in (fingers out, carry the one) nine months ago. While Valve is no doubt making every single Steam Deck it can, the reality of the current chip shortage (fave.co/3wOPaBP) means that even some of those early reservations are probably still waiting for their Steam Deck to arrive.

If you order a Steam Deck today, the company's website currently says you shouldn't expect to see it on your doorstep until after the third quarter of 2022, around October. If reviews are positive—and initial feedback shows that they probably will be—it might be hard to find a Steam Deck all through this year and into the next.

Intel's newest laptop chips power a fresh generation of affordable notebooks

Intel dominates the laptop market, though AMD is coming on strong. **BY MARK HACHMAN**



If history is any guide, your next notebook's new processor has now launched, as Intel recently unveiled a fresh lineup of 12th-gen Core CPUs for laptops—specifically speaking, the chips codenamed Alder Lake-P for mainstream notebooks, and Alder Lake-U for ultraportable PCs and tablets.

Intel ships about 80 percent of all notebook PC processors (fave.co/3JvTPOH)

VIDEO: **AMD RYZEN 9 6900HS iGPU**
Watch now at fave.co/3tL9ggF

IMAGE: INTEL

each year, meaning that you'll probably end up buying a notebook PC with one of these new chips inside. In January, Intel announced the Alder Lake-H (fave.co/3IjREg4), Alder Lake-P, and Alder Lake-U series as part of Intel's notebook processor plans for 2022. Because of the way in which Intel rolls out its new chips, we already have our first review of the 12th-gen Core i9-12900HK (fave.co/3sbkwCh), a fire-breathing, gaming-class processor that crushed the (older) laptop competition.

It's less likely, however, that you'll buy a gaming laptop (fave.co/3n3aNKv) in 2022 than a more mainstream device. Intel believes more than 250 different laptop models will include these new P- and U-series chips, which have begun shipping. (Intel says that the proportions will favor the U series over the P series, roughly 75 percent to 25 percent.) Unfortunately, however, we don't yet have one of these new P-series or U-series notebooks in for testing, so we've instead described what we know about these new chips—including their specs, features, and estimated performance—in our summary below.

Don't count out AMD, Intel's chipmaking rival, either. The company recently announced Ryzen 6000 Mobile processors, which it is aggressively marketing at mainstream PCs. Our review of the new AMD Ryzen 9 6900HS chip showed it delivers game-changing performance for tiny laptops.

INTEL'S NEW ALDER LAKE-P CHIPS: MAINSTREAM PERFORMANCE

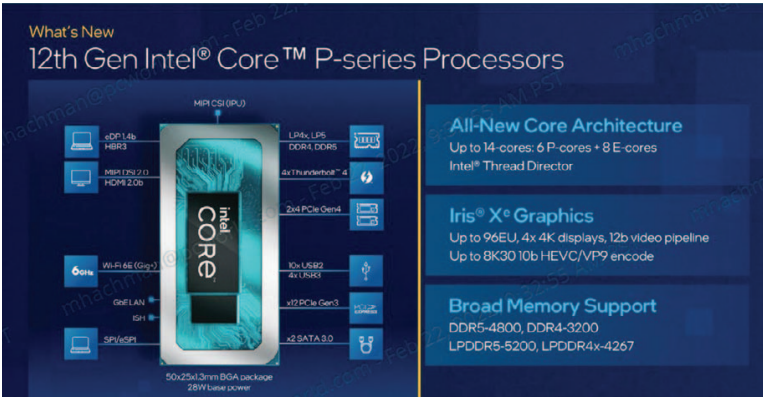
Remember, Intel's Alder Lake-P series chips carve out a new product designation that hasn't existed before. Intel classifies the "P" processor as "performance thin and light," implying that this will be its mainstream laptop offering. We're already seeing some business laptops adopt this processor, emphasizing performance without ditching the traditional laptop chassis for something thicker. The P-series chips consume 28 watts.

According to Dan Rogers, Intel's senior director of mobile product marketing, the reason to add a P-series processor wasn't for

For Performance Thin & Light Laptops

12th Gen Intel® Core™ P-series 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	Processor Base Power	Max Turbo Power	Intel vPro®
intel CORE i7	i7-1280P	14C	20T	6P	8E	24MB	4.8 GHz	3.6 GHz	1.8 GHz	1.3 GHz	96EU	1.45 GHz	28W	64W	Enterprise
	i7-1270P	12C	16T	4P	8E	18MB	4.8 GHz	3.5 GHz	2.2 GHz	1.6 GHz	96EU	1.40 GHz	28W	64W	Enterprise
	i7-1260P	12C	16T	4P	8E	18MB	4.7 GHz	3.4 GHz	2.1 GHz	1.5 GHz	96EU	1.40 GHz	28W	64W	Essentials
intel CORE i5	i5-1250P	12C	16T	4P	8E	12MB	4.4 GHz	3.3 GHz	1.7 GHz	1.2 GHz	80EU	1.40 GHz	28W	64W	Enterprise
	i5-1240P	12C	16T	4P	8E	12MB	4.4 GHz	3.3 GHz	1.7 GHz	1.2 GHz	80EU	1.30 GHz	28W	64W	Essentials
intel CORE i3	i3-1220P	10C	12T	2P	8E	12MB	4.4 GHz	3.3 GHz	1.5 GHz	1.1 GHz	64EU	1.10 GHz	28W	64W	-



Intel's 12th-gen Core (Alder Lake) P-series chips aren't specifically designed for discrete GPUs, though you may see some P-series PCs with a discrete GPU attached.

you the customer, but for PC makers—Intel's existing processors allowed PC makers to push power consumption and performance upward to 28 watts, but they weren't taking advantage of this capability. Carving out the new P brand told customers and consumers alike that they could expect higher performance, he said.

Intel's Alder Lake-P chips will include up to six performance cores and eight efficiency cores, with a total of 20 threads. (This explainer [fave.co/3u9Dj0q] can walk you through the difference between Alder Lake's new P-Cores and E-cores.) Processor speeds will begin at 1.5GHz for the performance or P-cores of the Core i3 chips, with up to 4.4GHz turbo options. At the high end, performance cores speeds will increase from a base clock of 1.8GHz, up to a maximum turbo clock speed of 4.8GHz.

Intel's Alder Lake-P series chips are designed for enthusiast levels of performance, but without some of the characteristics that would define a truly high-end PC powered by Intel's Alder Lake-H chips, Rogers said. For example, Intel's P-series chips lack the x8 PCI Express connection to the discrete GPU, because they aren't specifically designed for them. Instead, Intel's Alder Lake-P includes a pair of x4 PCI Express connections to connect to up to two SSDs. A pair of Thunderbolt 4 ports is supported as well, for connections to external Thunderbolt docks or external displays.

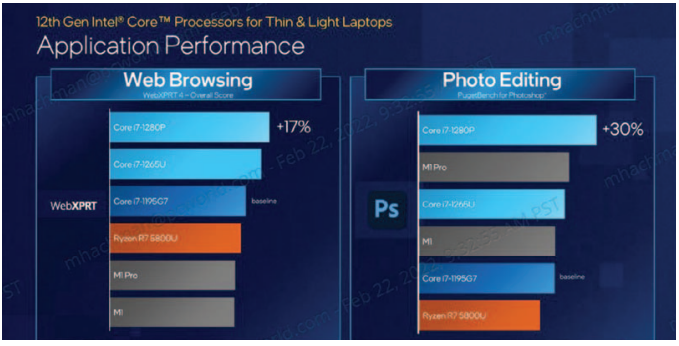
"The vast majority of P-series systems will be running integrated graphics," Rogers said. Laptops with discrete GPUs attached to P-series parts will ship, but will be "less common," Rogers said.

Instead of discrete GPU support, an Alder Lake P-series notebook will include an integrated Xe graphics core that's similar to Intel's 11th-gen integrated GPUs: up to 96EUs, with support for four 4K displays. As

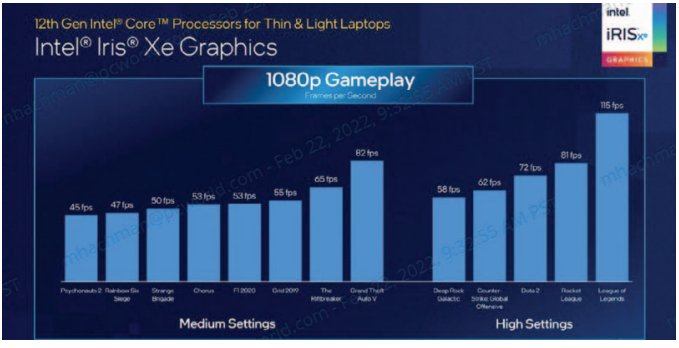
the chart above notes, the differences between the Core i3, i5, and i7 Alder Lake-P processors extend to graphics. As the number of EU cores decreases, you can expect the graphics performance to decrease as well.

The new Alder Lake P-series does allow for the same variety of memory support also found inside both Intel's desktop version of Alder Lake (fave.co/3FgvPfZ) and its mobile H-series chips: DDR5-4800, DDR4-3200, LPDDR5-5200, and LPDDR4x-4267. That will allow for some flexibility if you need to upgrade your laptop.

Intel is also offering an Intel imaging chip, the IMX488, that you may see in some laptops; Intel also refers to this as the Intel IPU 6.0. This probably won't be highlighted on the list of specifications, though Intel is promising you'll see better webcam performance as a result. (Intel is still recommending a 720p webcam as part of its premium Evo brand, because the size of the 1080p camera modules can be too large to fit inside some laptop bezels.) Intel is also including a new intelligent audio noise suppression capability, so that your roommate vacuuming in the background won't break into your Zoom call.

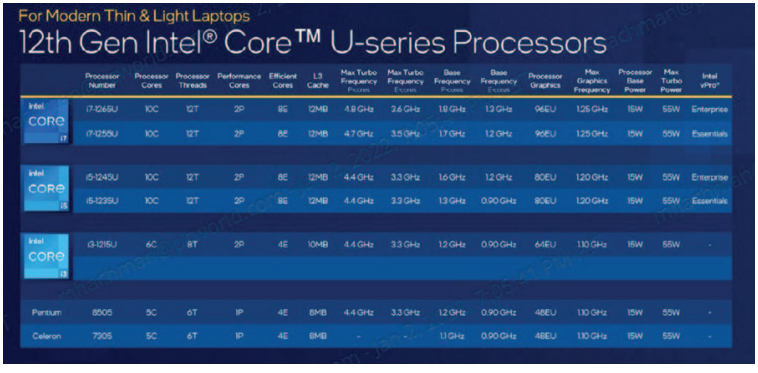


The performance of Intel's 12th-gen Core (Alder Lake) chips, as estimated by Intel in two popular application benchmarks.



Intel believes you'll be able to play a number of popular games on Alder Lake's integrated graphics, but sometimes at lower graphics settings.

From a performance standpoint, Intel is using the argument that it can't make generation-to-generation comparisons, as there were no 11th-gen P-series chips to compare them to. Instead, Intel provided two sets of benchmarks, one covering common productivity



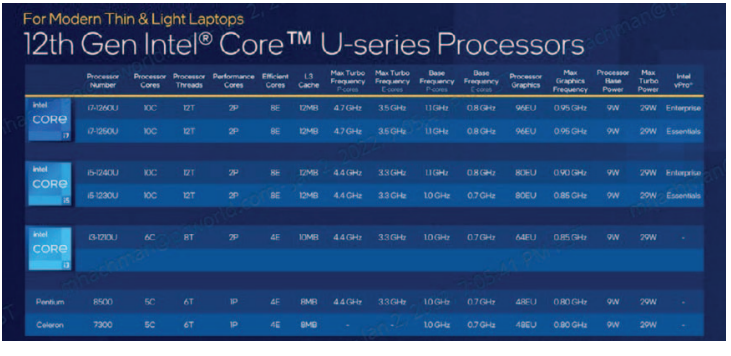
Intel's 15W 12th-gen Core (Alder Lake) mobile chips for thin-and-light PCs.

applications and the other a more generic gaming roundup. Intel believes that you'll be able to play many games using just the chip's integrated graphics, though potentially at lower settings.

INTEL'S U-SERIES: OPTIMIZED FOR LOW POWER

Intel's Alder Lake U-series chips are offered in one of two configurations: either 15 watts or 9 watts. At one time, Intel might have called these Y-series chips for ultralight laptops and Windows tablets. In any event, Microsoft will almost certainly offer them as options inside its Surface tablets (fave.co/31UYlG9), though whether they'll reside within the main Surface Pro lineup or the smaller, cheaper Surface Go line remains to be seen. The 9W chips are also designed for upcoming foldable PCs, though that category has remained a bit of a white whale to date. Naturally, long battery life is more the focus here, rather than performance.

Designing the same processor for two different types of machines will affect performance, though the core counts will be the same across the U-series line: two performance cores, and between four and eight efficiency cores. If you opt for a thicker, more full-featured laptop with an Alder Lake-U



Intel's 15W 12th-gen Core (Alder Lake) mobile chips for thin-and-light PCs.

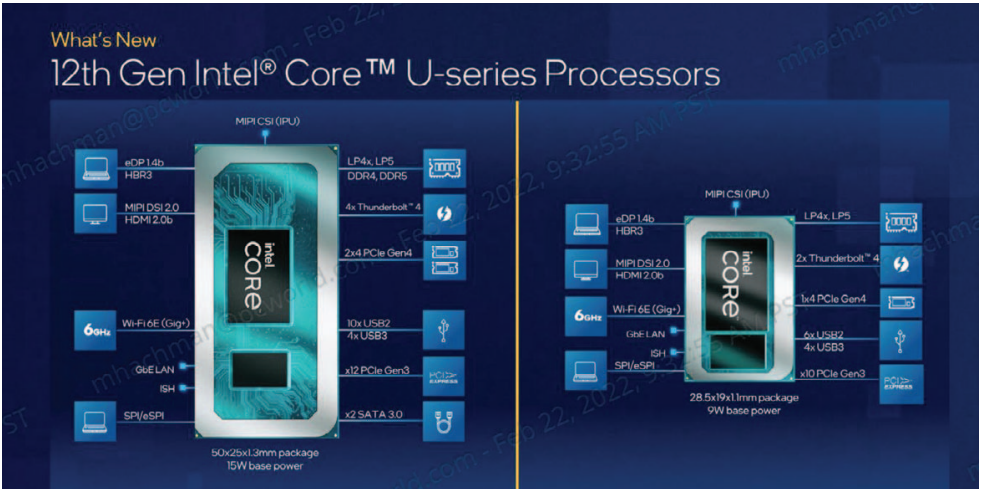
series chip inside, you'll be buying at least a Core i3 chip with a base P-core frequency of 1.2GHz, up to a turbo frequency of 4.8GHz. A U-series Core i7-1265U's two performance cores will run at 1.8GHz at its base frequency and 4.8GHz while in turbo mode. The graphics capabilities will be about the same as those of the P-series chips in terms of EU count, though the clock speeds have been dialed down to conserve power.

Both the 15W and 9W configurations also include Pentium and Celeron options, shrinking down the core counts further to save cost at the expense of performance.

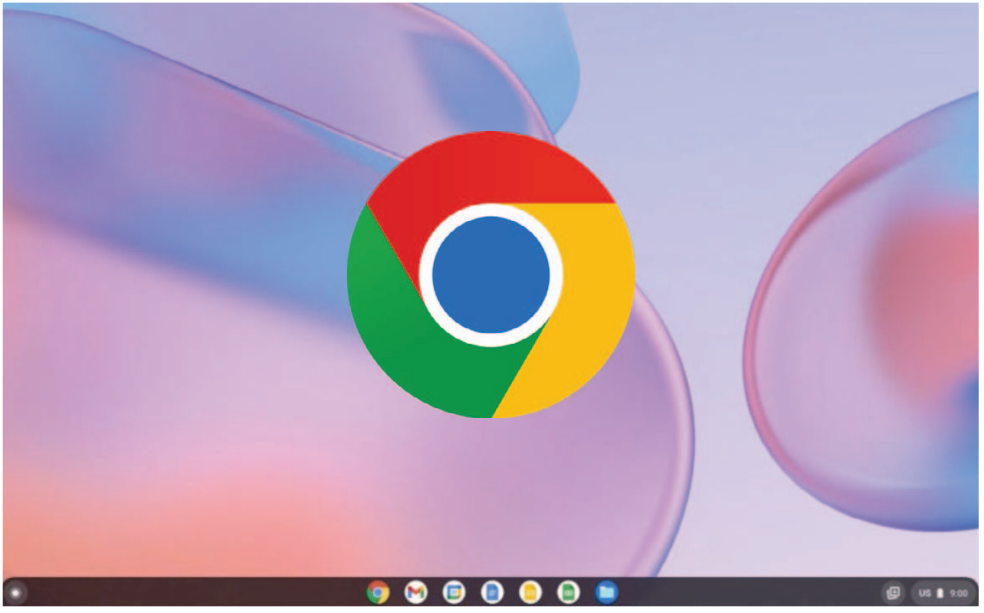
The lower-power 9W U-series chips dial down the core clocks dramatically, though the number of cores remains the same. Note how the Core i3 base frequency, at 1.0GHz, is lower than the 15W option; the Core i3 turbo clock for the performance core is still 4.4GHz. At the high end, the base P-core clock speed increases from 1.1GHz to a turbo speed of 4.7GHz.

We don't have performance data for Intel's new U-series chips…but consumers probably won't be buying them for performance. The key metric, though, will be battery life—and we don't know much about the actual numbers there, either.

That shouldn't matter, however. Now that Intel has officially launched both the Alder Lake U- and P-series, we should be seeing more and more notebook PCs with them inside, especially with Intel's plans to expand its Evo premium notebook brand even further (fave.co/3GOsmX3). We'll have a good idea of how they shape up before long. Stay tuned to our roundup of the best laptops (fave.co/3qL4oHf) to see how Intel's new chips shake out.



Even the slimmest Alder Lake tablets will have Thunderbolt capability, Intel says.



Google's free Chrome OS Flex can turn an old PC into a Chromebook

Google describes Chrome OS Flex as a newer version of its CloudReady technology.

BY MARK HACHMAN

Google has released Chrome OS Flex, a way to take older Windows and Mac hardware and replace the operating system, turning them into Chromebooks. It's an interesting development given Windows 11's strict hardware requirements (fave.co/3C7aDbn), which could leave legions of older PCs stranded when Windows 10 goes end-of-life in 2025.

Although Google is calling Chrome OS Flex an "early access" and "unstable" project, the concept is intriguing: Instead of disposing an old PC that's nearing the end of its life, you can turn it into a Chromebook instead. Google has launched the new operating system on its dedicated Chrome OS Flex site (fave.co/3ipeVm2), though you'll have to sign up with an email to receive download instructions.

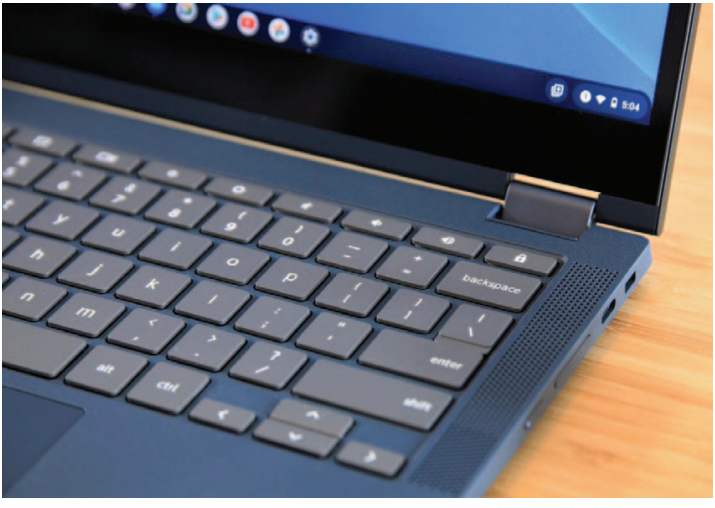
IMAGE: FRANKHH/SHUTTERSTOCK

Google appears to be positioning Chrome OS Flex for a dual purpose: a way for consumers to try out the benefits of Chromebooks, and a way for enterprises to evaluate how well they can be managed. For example, a Chrome OS Flex "fleet" can be managed with Chrome Enterprise Upgrade, Google says. If this all sounds familiar, you're right: Google bought CloudReady a few years ago, and used that company's work as a way to turn laptop PCs into Chromebooks (fave.co/36zeTFF). Google describes CloudReady as a "previous version of Chrome OS Flex." "Google will automatically update CloudReady devices to Chrome OS Flex, when Chrome OS Flex is stable," the company added.

Traditionally, DIY PC enthusiasts would either leave an older PC running, scavenge it for parts, or replace the Windows operating system with a resource-light version of Linux. Now, Google is offering them an additional option: Replace Windows with Chrome OS, and enjoy the benefits of that streamlined operating system. And that's a point to be reiterated: Chrome OS Flex doesn't offer the ability to run Chrome OS in a window or a virtualized environment, à la the new Android apps for Windows. Instead, it replaces Windows and all of its files.

On a support page (fave.co/3ilW1fN), Google says that Chrome OS Flex will be a more limited version of CloudReady, at least for now: "Chrome OS Flex will not allow some system-level access currently available on CloudReady Home Edition, including: command line access via shell and command line access via teletype (TTY)," Google says.

Don't expect things to go smoothly, either. "This operating system is still in early access on the dev channel—you may experience some instability," Google says.



Google warns that adding Google Chrome OS Flex to an older PC may mean you'll be using Chrome with a keyboard that wasn't explicitly designed for it, so certain functions may not work or may behave erratically.

Installing Google Chrome OS Flex looks similar to installing Windows 11 via installation media on a new PC. You'll need a USB key with 8GB or more. PCs will need at least 4GB of RAM and 16GB of storage. The CPU restrictions are more lenient: You'll need a 64-bit CPU, period, which is basically any processor made after the year 2000. There are GPU restrictions, though: Intel GMA 500, 600, 3600, and 3650 graphics hardware do not meet Chrome OS Flex performance standards, Google says.

Google has published a list of "certified models," which includes Asus's VivoBook L203MA (pictured here).

The real gotcha, however, appears to be simply in the diversity of compatible PC hardware, and how it will interact with Chrome OS Flex. Google has published a list of "certified models (fave.co/36yJovo)" that are either currently certified or planned to be certified with Chrome OS Flex, and many, many of them are listed with the caveat "minor issues expected" next to them. ("Models are likely to support at least basic functionality, but are still being worked on by our team," Google says rather circularly, in describing what "minor issues" might mean. "You might run into minor issues.") The certified models include both PCs and Macs.

So why wouldn't you want to install Chrome OS Flex on an older PC? Well, there is the substantial list of caveats (fave.co/3qmFm03) that come with the installation. For one, you can forget about Android apps, Google Play, or Parallels Desktop support—that's out, Google says. Google can't manage firmware updates on Chrome OS Flex devices, nor can it provide verified boot capabilities. ARM PCs? That's a hard no as well.

All this makes it seem like adding Chrome OS Flex to an older PC is very much a "use at your own risk" type of project—but one that can still turn your older PC into a Chromebook, for free. It's worth checking out before you toss your machine out.

4 lessons Microsoft can learn from the Apple Mac Studio

Apple's new Mac Studio delivers what Microsoft Surface Studio fans have been requesting for years. **BY MARK HACHMAN**

Apple's new Mac Studio (fave.co/3JtvwBb) not only includes what could be the most powerful processor in the PC landscape, but also exposes (and solves) many of the weaknesses of its direct rival, Microsoft's Surface Studio. If Microsoft takes these lessons to heart, however, imagine what a Surface Studio 3 could look like.

Microsoft's gorgeous all-in-one hasn't been refreshed in years, but its iconic swiveling 28-inch PixelSense touch display captured both hearts and minds when the $4,100 Surface Studio first debuted in 2017 (fave.co/3pgYlti). Now Apple's Mac Studio, a $3,999 small-form-factor Mac, has stepped in to fill the void, with the $1,599 Apple Studio Display (fave.co/3iqLFew) sitting alongside.

IMAGE: IDG

Microsoft's hardware division has held its head high throughout the last decade or so, shipping everything from tablets to laptops to unique combinations of the two (fave.co/3LQurF9). Apple, meanwhile, has garnered a reputation for quietly watching trends take hold, adopting them, and trumpeting the outcome as something new. That criticism doesn't really hold true here. In fact, Apple has set some new standards that Microsoft might learn from.

Apple's Mac Studio.

1. SHIPPING IT

Simply put, it's been three and a half years since Microsoft announced the Surface Studio 2 in October 2018 (fave.co/3uhMYSC), about 18 months after the Surface Studio shipped in April 2017. Yes, the pandemic has played a role, as have Microsoft's other priorities. But with a seventh-gen Intel Core chip inside the Surface Studio 2 as well as an aging Nvidia GeForce GTX 1070, it's hard to argue that the Surface Studio 2 is the preferred tool for creators within the Windows ecosystem.

Instead, that role falls to the Surface Laptop Studio (fave.co/3LQurF9), which trades some of the resolution offered by other Surface devices for a high refresh-rate screen. Some issues with the high-refresh-rate capabilities and performance held the Surface Laptop Studio back from an Editor's Choice award, but it's clearly the best Surface Microsoft makes at the moment. And it's available, of course—as is the Mac Studio.

2. A STANDALONE DISPLAY

The way in which the Surface Studio 2's massive 28-inch 4500×3000 display raises and lowers, transforming from an IMAX-like monitor to an artist's easel, is an iconic experience that's intrinsically tied to the Surface Studio line. But it doesn't have to be. The way in which the Studio was constructed—with the components built into the base rather than behind the screen—doesn't preclude the hinged display from being sold separately, replacing the Studio's CPU and motherboard with a solid support instead.

Apple's approach of designing a standalone hardware chassis and selling a separate display is its pay-through-the-nose business model, once again. But the Mac Studio allows customers to buy up to four of its $1,599, 5K Apple Studio Displays—which,

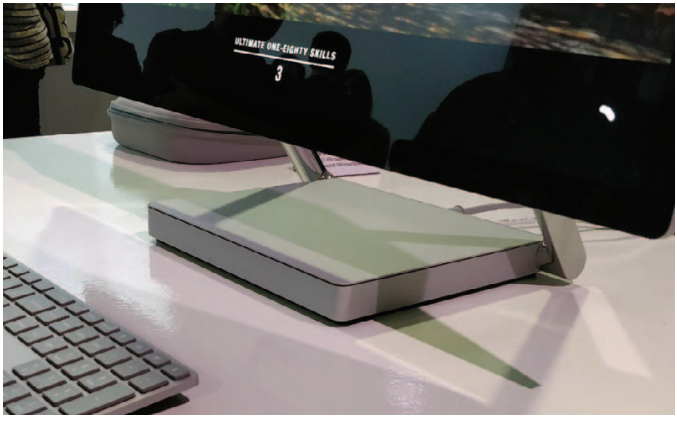
Standalone displays! What a concept.

of course, you can buy separately. This is *exactly* what Studio (or just technology fans) have been requesting for years, and there's no reason Microsoft couldn't do the same if it chose to. Why not empower customers to pair their best computer with Microsoft's best display, or the best available monitors in the wide-open PC ecosystem?

Remember, the Mac Studio has both HDMI and Thunderbolt out. There's absolutely nothing, such as a proprietary connector, that requires the Mac Studio to pair with an Apple Studio Display. Would a Mac creator pair a Mac Studio with a touchscreen Surface display they could swivel down and ink upon? I bet yes.

3. DESKTOP PERFORMANCE

Clearly, the most jaw-dropping aspect of Apple's launch was Apple's announcement of both its "monster" chip, the Apple M1 Ultra processor (fave.co/3qmsF5u), and the fact that it would be built into what is essentially a small-form factor PC. That's an enormous bar



The base of the Surface Studio 2. There's no hard-and-fast rule that it has to be a particular size. Feel free to make it thicker and more powerful.

to clear for a PC industry that's predicated upon the powerful but power-hungry X86 CPU architecture.

But the integrated Surface Studio 2 launched with mobile components inside—and it really didn't need to. If Microsoft's going to continue with the integrated all-in-one approach, replace the laptop hardware with more powerful parts, including a GPU that can challenge what Apple offers. Make the base a little bigger.

Yes, there's a ton of high-bandwidth Thunderbolt ports on the rear of the Mac Studio, but there's more on the front, too. And Apple specifically called that out during its announcement, too.

Today, the Surface Studio 2's base has about half the volume of the Mac Studio—219 cubic inches to 111 cubic inches. But does absolutely anyone care how thick an all-in-one PC's base is? I'm going to argue the answer is no—you're looking at the screen, not the hardware it's mounted upon. If anyone at Microsoft objects, buy them a ticket to Cupertino. It can't be that hard.

4. PORTS, PORTS, PORTS

I made this point in a Twitter exchange (fave.co/3wqxSgw) this week: I don't care how many ports a laptop includes, I care how useful they are. The Mac Studio with an M1 Ultra inside includes four Thunderbolt 4 ports on the rear and two more on the front. (There are also two USB-A ports, and even a headphone jack!) That's a massive amount of bandwidth, suitable for the aforementioned multiple Mac Studio displays as well as other external devices.

The Surface Studio 2 included four USB 3.0 Type A ports and put them all on the rear of the Studio. That was simply a dumb decision, even if the Studio debuted before the ubiquity of USB-C and the growing influence of Thunderbolt technology. If and when a Surface Studio 3 debuts, I'd like to see Microsoft approach the ports issue in much the same way Apple does.

It's possible that Microsoft will actually ship a Surface Studio 3 (fave.co/36gwiCX) later this year. And yes, if that's true, it might be difficult to steer the ship in a new direction so late in the game. But so many of these design directions have been asked for, for years. It's just unfortunate that Apple has been the company that answered the call.

Stolen Nvidia certificates used to hide malware in driver downloads

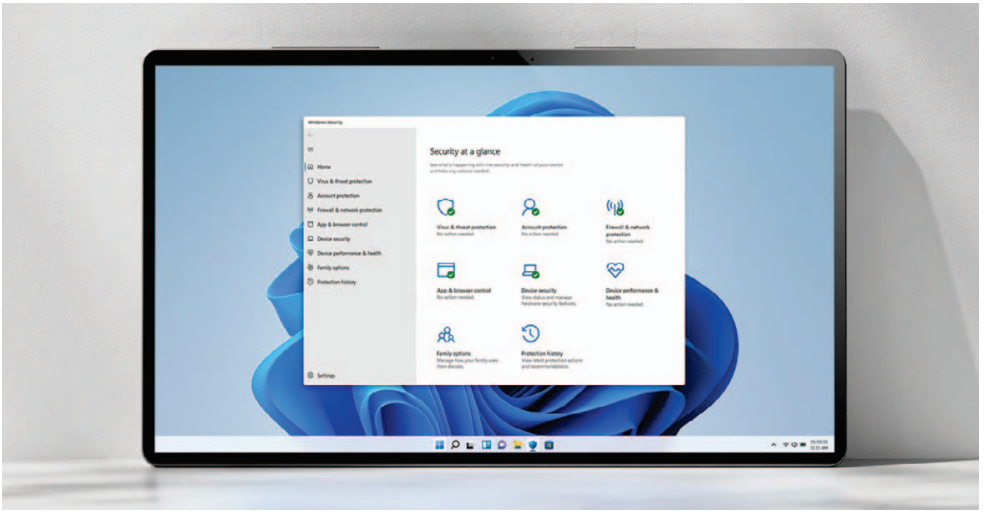
Nvidia GeForce graphics card owners may be vulnerable to malware if they're not careful with their next driver installation. **BY MICHAEL CRIDER**

Last week Nvidia confirmed that it had been the victim of an internal hack, though it claimed no customer information was compromised. While the hackers have made some very strange demands, threatening to release sensitive corporate data if Nvidia doesn't unlock some of its most powerful graphics cards for cryptocurrency mining (fave.co/3iv9ou1), regular users didn't need to worry much. Today we're seeing one of the first effects of the hack on end users: Nvidia GPU driver packages with malware hidden inside.

While it was always possible for malefactors to host links pretending to be drivers in the hopes of installing viruses, Trojans, and other nasty stuff on a user's PC, this situation is more concerning. The hackers appear to have leaked Nvidia's official code-signing certificates, a means by which users (and Microsoft) can verify that a downloaded program comes from the publisher it says it's from.

That's allowing files containing a host of popular malware suites to be posted and downloaded, bypassing Windows Defender's

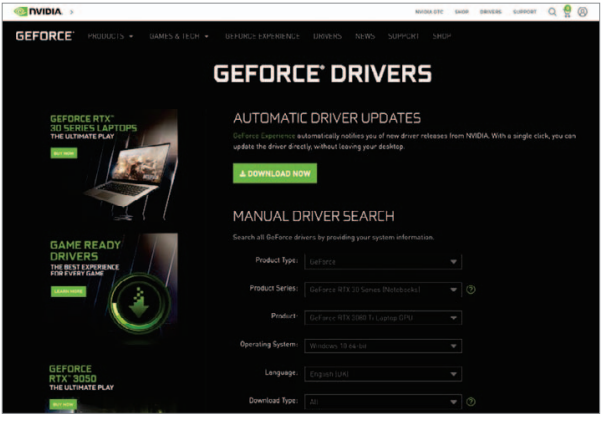
IMAGE: IDG



You can block the installation of packages with the expired codes using Windows Defender.

built-in executable verification and slipping past antivirus software. BleepingComputer reports that two now-expired (but still usable) verification codes have been compromised and used to deliver remote access Trojans (fave.co/3uijOTm). Another example, using the Nvidia verification to sign a fake Windows driver, was also spotted.

While it's possible to block the installation of packages with the expired codes using Windows Defender, it's an advanced technique that's probably only of interest to your company's sysadmin (fave.co/3Nb1BQc). For regular users looking for the latest graphics card drivers (or any driver, for that matter), the advice is the same as always: Be careful to only download it from the official source—the Nvidia website (fave.co/3qnNWf2) or, in this case, your installation of GeForce Experience.



Make sure you only download drivers from official sources.

Microsoft continues to fix Windows 11 with changes to Taskbar, Widgets

These small improvements should add up over time. **BY MARK HACHMAN**

Windows 11 has continued to tack away from its launch state, issuing new features that are mainly course corrections from its initial approach. Windows 11 Insider Preview Build 22563 is a case in point, bringing fixes to the taskbar for tablets and an improved Widgets experience.

It's a theme we talked about in our recent video describing the Windows 11 spring 2022 "update" (fave.co/3CZx0R8): Microsoft released its new Windows 11 OS, users complained, so Microsoft backtracked. For example, Microsoft released Windows 11 (fave.co/3cdEtj3) with minimal changes to the taskbar experience for tablets such as the Surface Pro 8. Specifically, while Windows 10 alters the taskbar when a tablet like the SP8 is undocked, Windows 11's stable configuration leaves it largely unchanged.

IMAGE: MICROSOFT

1.

Collapsed state shows critical status icons only.

Expanded state allows for easier touch interactions.

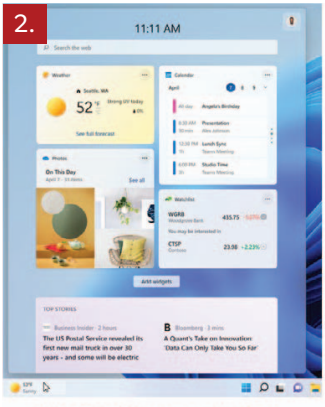
Build 22563 makes a welcome change. One of the concerns with a tablet is how easily you'll inadvertently click something you didn't mean to. In the new build, the taskbar slims down into just a tiny ribbon at the bottom of the screen. If you swipe up, it expands into a more easily navigable area. Yes, it's a second click, but it's like sliding a utility knife back into its sheath when it's not in use—you're trading a bit of inconvenience for additional safety (**1**).

The changes to Widgets are more subtle—and probably will be more discernible once we get some hands-on time with the new build.

"We're trying out some changes in Widgets to bring more dynamic content to your Widgets board, by experimenting with bringing together the widgets and news feed experiences as a dynamic blended feed containing both widgets and news content," Microsoft said in a blog post (fave.co/3il8ujY). "This should make it easier for you to discover and engage with new widgets and news content through your feed. With a dynamic feed there's less of a burden on you to curate the canvas on your own, but you'll still be able to pin your favorite Widgets to the top if you want."

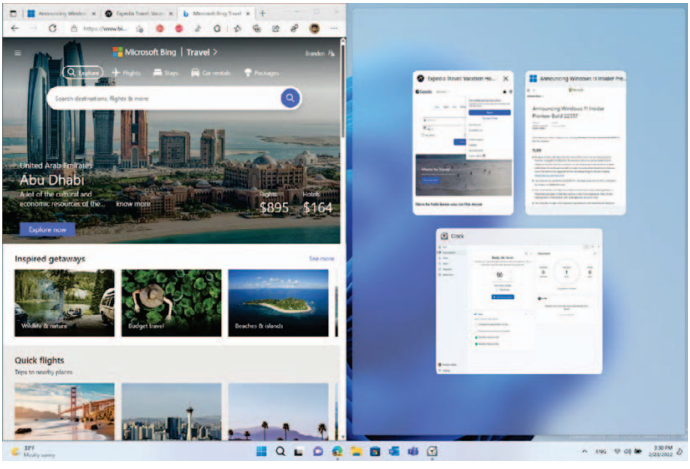
From the illustration Microsoft provided, there really don't appear to be substantive

2.



What Insiders see before.

What Insiders will see with dynamic content.



Windows 11's Snap Assist will now suggest Edge tabs.

changes to Widgets before and after the new build (**2**).

Instead, it looks like Widgets is being made more flexible, so that you'll discover and add new widgets to the feed. Note that the "add widgets" button appears to have moved to the top, where there's now a small plus-sign (+) icon that appears next to your avatar icon.

Microsoft also made some other small changes. The first appears to be a continuation of Windows 10's behavior in Snap Assist. If you snap an app to one side or a corner of the screen, Windows suggests other apps to fill the space. Now, the first three "apps" Windows 11 suggests will be your most recent three tabs opened within Microsoft Edge, and then other apps. Microsoft says that you'll be able to control this behavior via the Alt+Tab controls: Settings > System > Multitasking inside the Settings menu.

Microsoft has also changed the search behavior in Quick Access, the search bar at the top right of any File Explorer window. Now, in addition to searching files stored locally on your PC, Windows will add a search of your OneDrive content as well.

Starting with this build, Windows Insiders can now use 37 new emoji characters in the emoji picker as part of Emoji 14.0 (fave.co/3LjjIrd), the company added. They include "troll," "melting face," and "mirror ball" emoji (**3**).

Technically, these improvements are all part of the Dev Channel, so Microsoft is under no obligation to bring them to the stable channel of Windows. But these feel like fixes that you'll see soon regardless.

What DisplayPort's new Ultra-High Bit Rate (UHBR) certification means to you

UHBR makes it simpler to shop for a DisplayPort 2.0 cable. **BY MATT SMITH**

The Video Electronics Standards Association (VESA) has announced a new DisplayPort certification called Ultra-High Bit Rate (UHBR) (fave.co/3tpP1VB) for DisplayPort 2.0. It establishes two levels of certification, DP40 and DP80, that mark cables as capable of up to 40 and 80 gigabits of data, respectively.

VESA intends this to clear up any confusion, but I'll bet it has left you scratching your head. Here's what UHBR means for you.

WHAT IS DISPLAYPORT UHBR?

DisplayPort Ultra-High Bit Rate (UHBR), a set of transmission modes included in the DisplayPort 2.0 standard, comes in three flavors.

IMAGE: IDG

UHBR promises a certain minimum bandwidth per DisplayPort lane. DisplayPort 2.0 has four lanes, so effective bandwidth in use is four times what each UHBR transmission mode provides. Here's the breakdown.

- UHBR 10 (4×10 = 40Gbps)
- UHBR 13.5 (4×13.5 = 54Gbps)
- UHBR 20 (4×20 = 80Gbps)

Video requires bandwidth, like any other data, so more bandwidth translates to support for higher video resolutions and refresh rates.

WHAT IS UHBR CERTIFICATION?

The DisplayPort 2.0 standard provides for the UHBR transmission modes listed above, but that doesn't mean devices and cables need to support them all. Each DisplayPort device maker decides the speeds its device can handle. That's where VESA DisplayPort UHBR certification steps in. It will certify that DisplayPort cables, video sources, and displays can handle a minimum bandwidth. The program covers two certifications.

DP40: A minimum of 40 gigabits, available via UHBR 10

DP80: A minimum of 80 gigabits, available via UHBR 20

Notice that there's no DP54 certification, which would be the equivalent of UHBR 13.5. VESA has decided not to certify it separately, instead noting that all DP80 cables can handle UHBR 13.5.

WHAT DOES UHBR MEAN FOR RESOLUTION AND REFRESH RATE?

The UHBR certification is meant to simplify buying a DisplayPort 2.0 cable, but it doesn't make any specific promise about supported resolutions and displays. This is likely because the variety of use cases DisplayPort can handle is too complicated to reduce to a single figure.

That said, you can expect DP40 cables to handle a single display at 4K resolution up to 144Hz or 8K up to 30Hz, while DP80 can handle 4K up to 240Hz and 8K up to 85Hz.

These figures are for uncompressed video. The use of Display Stream Compression (DSC) can bump DP80's maximum resolution to 16K at 60Hz.

DOES UHBR APPLY TO DISPLAYPORT OVER USB-C AND THUNDERBOLT?

The DisplayPort Alternate that's optional for USB-C, and mandatory for Thunderbolt, complies with the same DisplayPort standards as a typical DisplayPort cable. It can implement UBHR, and devices using it can be certified for DP40 or DP80 in the same way. However, the current maximum data speed of USB-C 4 and Thunderbolt 4 is 40Gbps, so DP80 certification is out of reach.

VESA states USB-C to DisplayPort adapters certified for UBHR will "soon become available," so perhaps certified USB-C cables will appear as well.

DisplayPort 2.0 UHBR labeling on cables.

HOW DOES THIS COMPARE TO HDMI 2.1?

DisplayPort's UHBR certification could be interpreted as a response to recent controversy surrounding HDMI 2.1.

The HDMI Licensing Administrator recently "retired" HDMI 2.0, which is "superseded" by HDMI 2.1a (fave.co/3uckFFm). But this doesn't mean all new HDMI devices and cables have the full maximum capabilities of HDMI 2.1a. Instead, HDMI 2.1a now encompasses a range of capabilities defined by the previous specification (fave.co/3luqPpo).

Confusing, right? Those who need high-performance HDMI 2.1a cables can at least look for Ultra High Speed cables, which must support at 48Gbps of bandwidth, but there's no such shortcut for devices. It's hard to know if a TV, monitor, or PC supports the features and bandwidth you want.

The DisplayPort UHBR certification avoids this problem, providing two clear tiers that make a specific promise about bandwidth.

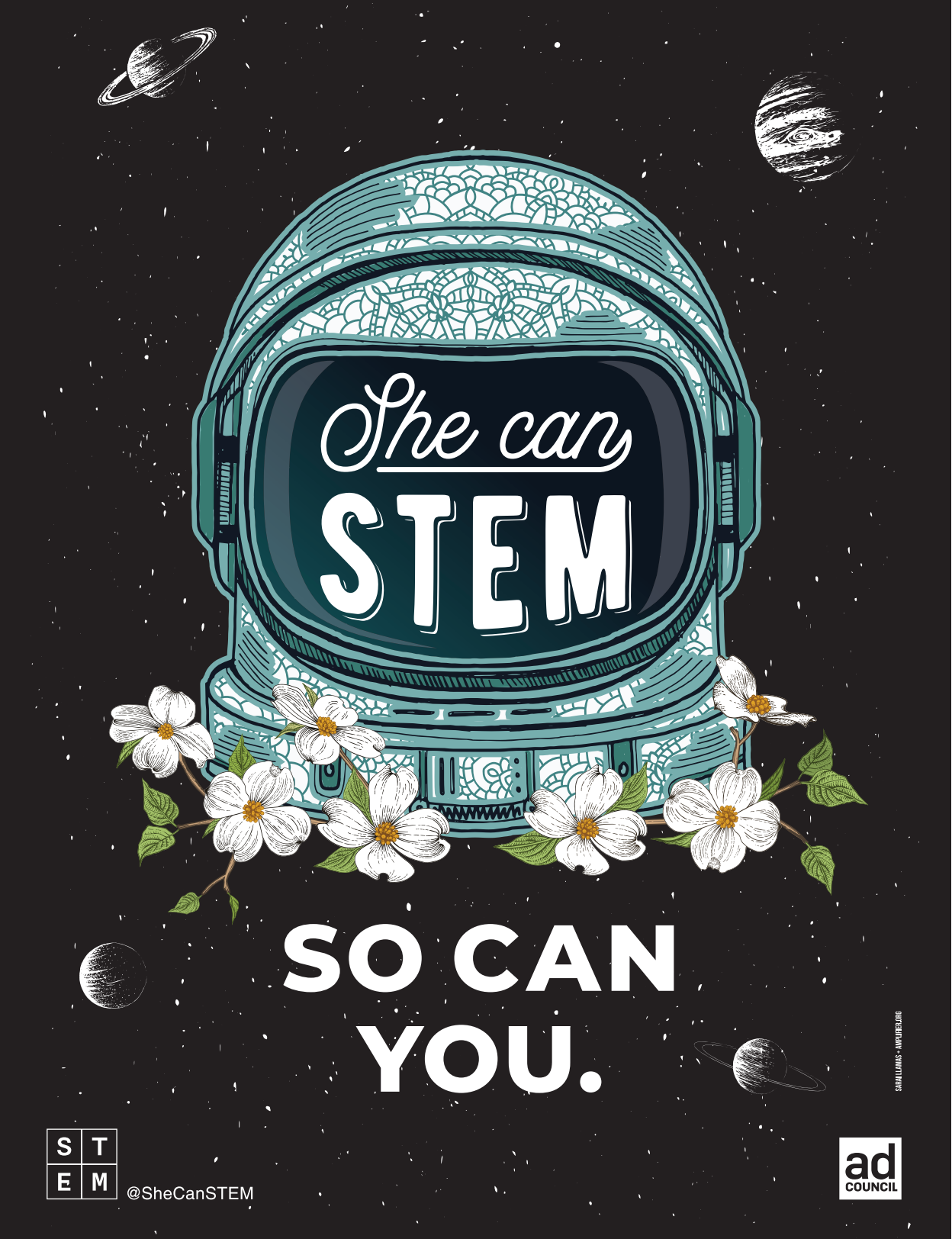
CONCLUSION

Still a bit confused about DisplayPort UHBR? Here's the breakdown.

- DisplayPort UHBR delivers at least 40Gbps, and up to 80Gbps.
- Devices and cables certified for DP40 and DP80 provide at least 40Gbps and 80Gbps, respectively.
- DP40 can handle up to 4K at 144Hz, while DP80 can handle up to 8K at 75Hz.
- The use of Display Stream Compression can bump DP80's maximum resolution to 16K at 60Hz.
- USB-C 4 and Thunderbolt 4 can meet DP40 certification requirements, though device makers will have to submit for certification to advertise it.

Most people can grab any DisplayPort 2.0 cable (certified or not) and have a fine time. DisplayPort has the advantage of being overbuilt. Even DisplayPort 1.2 can handle 4K at 60Hz or 1440p at up to 144Hz.

But if you want to connect a cutting-edge 4K/144Hz monitor or a monitor with a resolution beyond 5K, or you plan to daisy-chain multiple DisplayPort monitors, you should keep an eye out for DP40 and DP80 certified cables. These will guarantee the bandwidth you need.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Asus ROG Zephyrus G14 (2022): This laptop punches above its weight class

Fast, tiny, and eye-catching. **BY GORDON UNG**

PCWorld EDITORS' CHOICE

The original Asus ROG Zephyrus G14 (fave.co/3ugiMr2) turned the laptop world on its head with an unheard-of performance-to-weight ratio for its day. Two years later, Asus is back with a redesigned ROG Zephyrus G14 that again challenges your notion of just how much performance you can jam into a tiny gaming laptop.

Much of this comes from its all-AMD design. Asus blends AMD's ultra-efficient new

VIDEO: **ASUS ROG ZEPHYRUS G14 (2022)**
Watch now at fave.co/3lAnnt7

IMAGE: ASUS

Ryzen 9 6900HS processor and Radeon RX 6800S graphics (fave.co/3BEfkK2) into the revamped ROG Zephyrus G14. Because both CPU and GPU come from the same parent, they're far more likely to shift power back and forth intelligently than, say, an Intel CPU and an Nvidia GPU.

The USB-C port on the left side of the Asus ROG Zephyrus G14 will eventually support USB 4 capability.

Asus helps this partnership by using a vapor chamber cooling design rather than conventional heat pipes. Vapor chambers share a larger surface cooling area between the Radeon and Ryzen than a traditional heat pipe system, and benefit CPUs and GPUs that closely share power and cooling.

Besides the new internals, Asus moves from the wide and squat 16:9 aspect ratio panel to the new hotness with a 16:10 aspect ratio screen with a resolution of 2560×1600. The panel is rated at 500 nits, 120Hz and 100 percent DCI-P3 color space.

More important, Asus finally gets a chance to fix the one feature that has always been a deal breaker on the original G14 laptop: It now has a webcam!

SPECS

CPU: AMD 8-core Ryzen 9 6900HS
GPU: AMD Radeon RX6800S
RAM: 32GB DDR5/4800 in dual-channel mode
Screen: Asus ROG Nebula Display 14-inch, 2560 x 1600, DCI-P3, 120Hz, 3ms
Networking: Wi-Fi 6E, Bluetooth 5.2 (MediaTek MT7922)
SSD: Micron 1TB 2450 PCIe 4.0 SSD.
Ports: MicroSD UHS-II reader, 2 USB-C , 2 USB-A 10Gbps, HDMI 2.0, analog audio jack
Size and weight: 12.3×8.9×0.73; 3.8 lbs. with AniMe Matrix, 3.6 lbs. without AniMe; additional 1 pound for 240-watt power brick
Price: $2,500

WEBCAM AND SPEAKERS

Besides the new CPU, GPU, and 16:10 screen, the most exciting change may be the Windows Hello webcam Asus has *finally* integrated into the Zephyrus G14. Although it's "just" a 720p camera, we found it about

1,000 percent better than the first and second generation models that, uh, had no webcam. Yes, no webcam on a laptop. Why? Asus introduced the original G14 in the innocent days of January 2020 and said an integrated webcam would never match an external one, so just use a better option. Besides, do you really use your webcam that much? Ah, such naïve 2019 thinking. Obviously the company didn't foresee the Zoom-filled hellscape our lives would become. Now finally, after two years, the company is integrating a webcam, giving the G14 the utility it should've had from day one.

The camera has a somewhat tight angle of view, which means you'll have to be dead center for Windows Hello facial recognition to work. And while the quality doesn't match laptops with 1080p webcams such as the MSI GE76 Raider, it's about what you expect and again, a huge improvement over not having a webcam at all.

We should also talk about the speakers on this laptop, which are acceptable for a laptop this small and hardware-packed. It's far from atrocious but not something you'll call someone over to listen to, which basically means the audio is *fine*.

WHAT ABOUT USB 4 AND USB PD?

AMD's Ryzen 6000 CPUs will be the first chips with USB 4 support (fave.co/3IpMBKJ) outside Intel's and Apple's chips, which both support USB 4 via Thunderbolt 4. AMD's USB 4 implementation will the first we can think of that didn't start as Thunderbolt based. For AMD, USB 4 will support the full implementation with up to 40Gbps transfer rates, PCIe tunneling, external graphics support, and DisplayPort 1.4a HBR3 (see page 19), as well as Thunderbolt support (for laptop vendors who receive certification). Basically, we're still waiting to see how

Webcams compared: Asus ROG Zephyrus G14 2022 (top left), HP Dragonfly Elite 2018 (top right), MSI GE76 Raider (bottom left), Asus ROG Zephyrus G14 2020 (bottom right).

the promised USB 4 world that *didn't* start on Thunderbolt shapes up.

With a 240-watt power brick, you might have expected the laptop to support the newest USB Power Delivery specs and exclusively charge using USB-C, which can now reach 240 watts. Asus officials, however, say they decided against a pure USB-C charging system due to the inefficiencies of it right now. Asus didn't totally pass on USB-C charging though. Like many of its laptops, it will charge through its USB-C port at up to 100 watts, so if you want to leave the larger 240 brick at home while on the road, you can do so provided you can get by with slower charging.

The trackpad is glass-smooth and very decently sized.

KEYBOARD AND TRACKPAD

One weakness of the original Zephyrus G14 was the meh keyboard, which had mediocre backlighting and felt a little mushy. The white backlighting is a little better on the G14 but certainly not the brightest we've seen. In a very dark room it's fine, but even in dim office lighting you'll find the backlighting washed out. More light seems to leak from around the base of the keys than through the letters, making them more difficult to see when the backlighting is on rather than off. That is partially due to the white backlighting on white keys. Gamers expecting very bright RGB backlighting won't find it here.

UPGRADE OPTIONS

For most laptops, the only real upgrade option is storage. Content creation and gaming laptops go one step further with memory, sometimes offering expansion storage. As it's a very compact laptop, you get a single full-size M.2 drive that you can

replace by removing the bottom panel of the G14 (attached with Philips-head screws).

For RAM, a single DDR5 SO-DIMM slot is accessible as well, but upgrade options get stickier. While you could replace that 8GB or 16GB DIMM module, the rest of the RAM is soldered to the motherboard. That means you get 8GB of permanent RAM with 8GB in a module on 16GB versions of the laptop, and 16GB of permanent RAM with 16GB in a module on the 32GB version. The issue will mostly apply to people who buy 16GB versions of the G14 with plans to upgrade their memory later. In that case, you'd have, say, 24GB of RAM (or 40GB if we see 32GB DDR5 modules, which would not all be running in dual-channel mode).

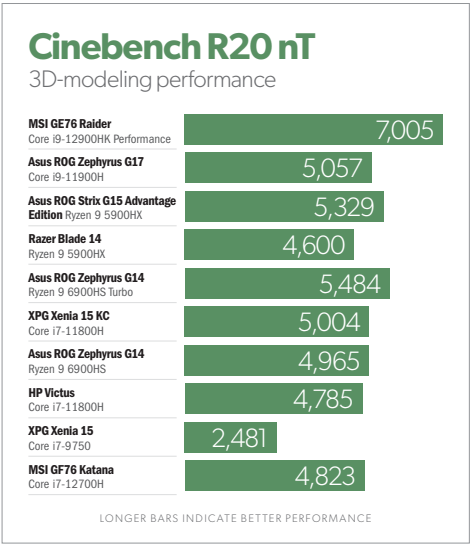
Is that a deal breaker? It very much depends on what you do, how much RAM you need, and whether you need bandwidth or capacity. If you're not the sort of person who typically upgrades the memory in your laptop, don't sweat it whatsoever.

PERFORMANCE

The real excitement of the newest ROG Zephyrus G14 is how it performs. We'll kick that off with Cinebench R20, a 3D rendering benchmark based on Maxon's Cinema4D engine. The more CPU cores you have, the better the performance. We actually tested the ROG Zephyrus G14 in its default "performance" setting as well as its "turbo" setting while it was plugged into the wall.

Although it can't dethrone the much larger and much faster MSI GE76 Raider with its 12th-gen Core i9 (fave.co/3sbkwCh), the performance for the G14 is nonetheless impressive given its size and weight. For example, the 3.7-pound laptop (it's even lighter without its nifty miniLED AniMe lid) outperforms the heavier and thicker ROG Strix G15 Advantage (fave.co/3q58nfL) with its Ryzen 9 5900HX CPU.

Although PC makers and CPU makers like to entice consumers with CPU cores, the vast majority of applications that people run don't use all of those cores. It's also important to look at single-threaded performance using Cinebench R20, which gives you a better indicator of how the G14 might run

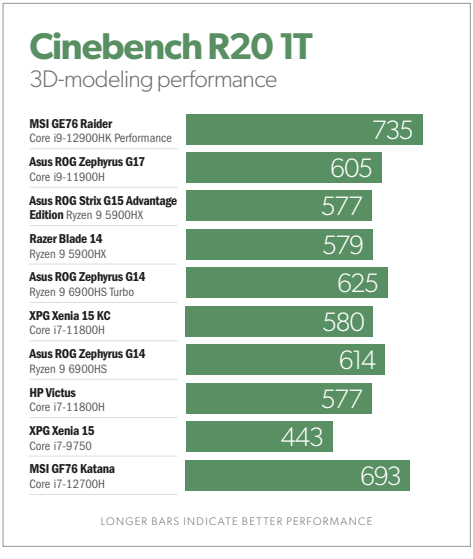


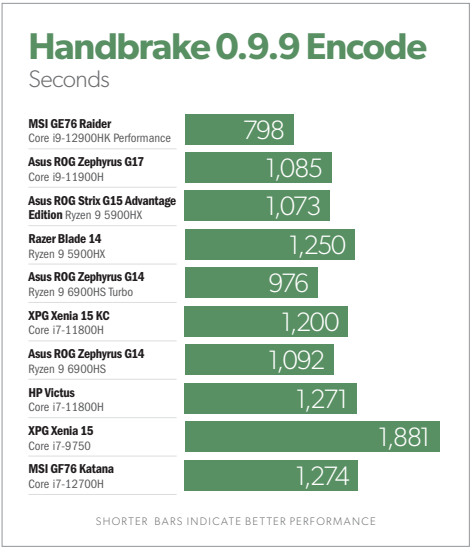
Photoshop or even browse the Internet.

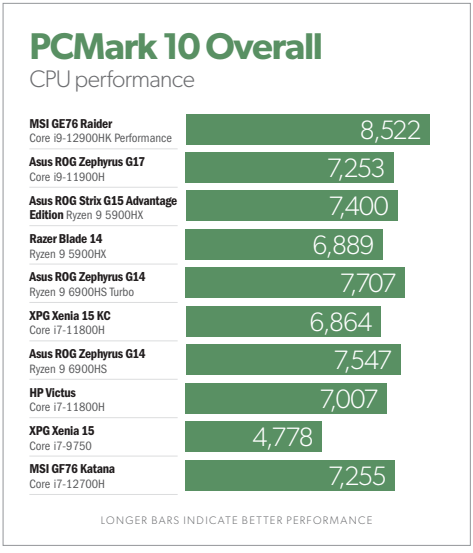
The single-threaded performance puts the G14 in good company and again confirms that most people won't notice the difference between a brand-new laptop and one that's a generation behind it. Laptops such as the MSI GE76 Raider and the GF76 Katana with their 12th-gen CPUs, however, would disagree somewhat as they clearly offer a crisper feel in lightly threaded tasks. Whether you can feel that, however, is up for debate. You basically won't be hurting for performance with the new G14.

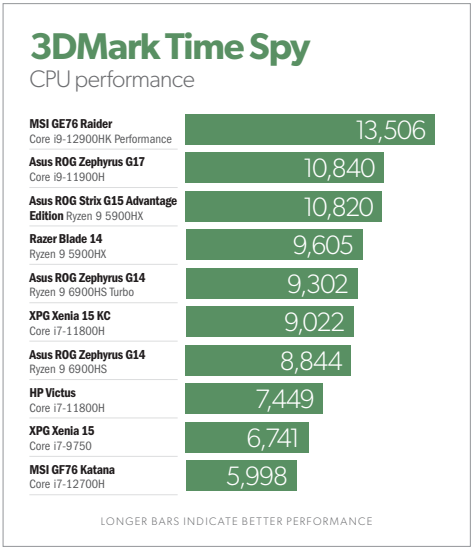
Most of the tests above are fairly short loads, so we also try to gauge the laptop's performance running a lengthier task. We use an older version of Handbrake to convert a 30GB 1080p video using the Android Tablet preset. On default, the G14 basically performs dead even with the thicker and heavier ROG Strix G15 Advantage Edition, and set to Turbo, it again punches above its weight class.

Looking for a somewhat lighter task, we also use UL's PCMark 10. It measures the performance of a PC running multiple tasks in text editing, photo editing, spreadsheets, and some content creation. Although PCMark 10 doesn't use commercial applications, its use of open-source free software at least gives us a good feel for how a laptop performs that's closer to reality. The result is again quite good for the Zephyrus G14, which is again performing far beyond its class. The results also show that for the most part, you're unlikely to really feel that much of a difference









between any modern laptops in these tasks. Obviously, the MSI GE76 Raider would disagree. It's clearly the fastest, which means it would likely be a little crisper.

Gaming performance on the Zephyrus G14 is clearly important. We say that because if you're going to pay for a laptop with a powerful discrete GPU, you probably want to use it. AMD's new Radeon RX 6800S is essentially a power-optimized version of the Radeon RX 6800M in the ROG Strix G15 Advantage Edition. You give up some performance to get into a laptop that's so much thinner, but the tradeoff is likely worthwhile if you value portability.

The ROG Zephyrus G14 is roughly 16 percent slower in Turbo mode compared to the ROG Strix G15. Nvidia's GeForce RTX 3080 is obviously very fast, but as you limit its power consumption, it gets closer than you'd expect, with the Razer Blade 14's GeForce RTX 3080 (fave.co/3543Kw6) only slightly faster than the ROG Zephyrus G14.

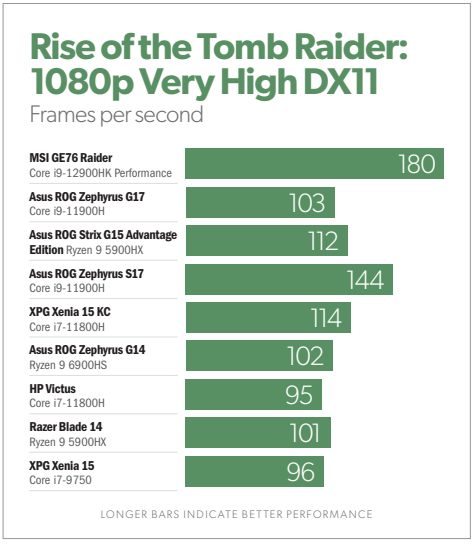
Synthetic benchmarks may reliable, but they're hard to relate to an actual game, so we run games to gauge performance. Not everyone plays cutting-edge games, so we use the 2015-era *Rise of the Tomb Raider* in DirectX 11 mode as a stand-in for older games. Clearly, the bigger and more powerful laptops with higher wattage GPUs win this, but the ROG Zephyrus G14 is again doing quite well considering its weight class. It's basically about dead-even with a GeForce RTX 3070 Laptop GPU with a 140 watt TGP, and it can outrun a GeForce RTX 3080 Laptop

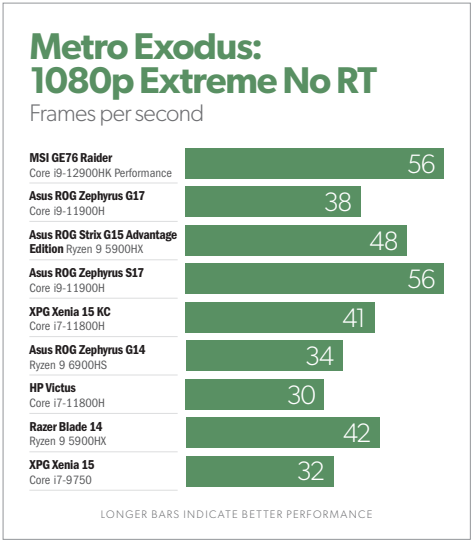
GPU with its wattage limited to 100 watts.

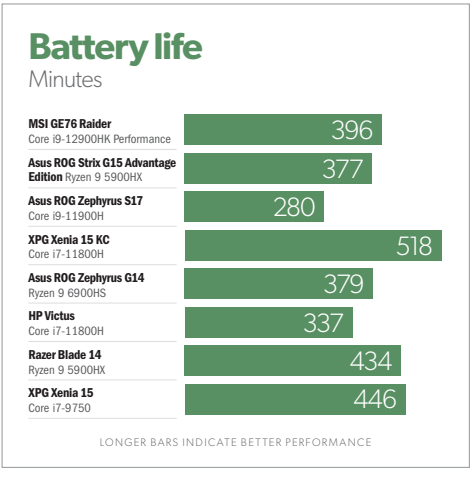
We did want to get a feel for the performance of Asus's laptop on a more strenuous game, so we use *Metro Exodus* set to its Extreme preset. The ROG Zephyrus G14 again offers exceptional performance for its weight, and again is neck and neck with the GeForce RTX 3070 and 3080 GPUs.

Our final test looks at the battery life of the Zephyrus G14 while playing a 4K video in airplane mode, with earbuds set to 50 percent volume and the screen brightness set between 250 and 260 nits. You may think it's all about the CPU or GPU for a video rundown test, but the size of the battery as well as how much power the screen consumes matter just as much.

Asus still manages to get a decent 74 watt-hour battery inside the G14 despite its small frame, which gives us just over six hours of runtime. That's fair battery life for a laptop with a QHD+ screen, but it can't quite match the XPG Xenia 15 KC (fave.co/3uBAw0r),







The Asus ROG Zephyrus G14 is one of the smallest, fastest, and flashiest laptops we've ever seen.

which also has a QHD screen as well as a battery that's 27 percent larger.

VERDICT

We can't stress enough just how much the original Asus ROG Zephyrus G14 wowed everyone in January 2020. At the time, it easily destroyed Intel's hulking 9th-gen gaming notebooks by offering far more performance in a very compact and very light laptop. As arguably the first AMD premium gaming laptop of the day, it also helped cement that an AMD laptop could be as good as or even better than its Intel-based rivals.

Today, the Asus ROG Zephyrus G14 faces far stiffer competition, but its improved in-your-face AniMe Matrix, impressive AMD CPU and GPU combo, and far better 16:10 panel and webcam remove any issues we had with the original version. It's certainly not a low-cost alternative like the original G14, with the new model sporting a price tag of $2,500, but you're getting one of the smallest, fastest, and flashiest laptops we've ever seen. The Asus ROG Zephyrus G14 punches far above its weight class.

Asus ROG Zephyrus G14 (2022)

★★★★½

PROS

- Powerful CPU and GPU performance in a very compact design.
- AniMe Matrix screams unique.
- It has a webcam.

CONS

- Half-permanent RAM.
- Keyboard backlighting is subpar.

BOTTOM LINE

The redesigned ROG Zephyrus G14 continues to stand out by offering a ton of performance, an eye-catching AniMe Matrix screen, and a new 16:10 screen and webcam.

$2,500

Intel Dragon Canyon NUC12EDBi9: Small form factor PCs made simple

This easy-to-build gaming PC offers more performance and fewer compromises than its predecessor. **BY ALAINA YEE**

Last summer, Intel leaned hard into its line of modular gaming PCs. Its launch of Beast Canyon (fave.co/3L9x9V3) (aka the NUCBTM) muscled up into small form factor (SFF) PC territory, with an eight-liter case capable of housing full-length graphics cards. The only compromise—if you could call it that, given the strong test results—was its soldered mobile chip.

Half a year later, the release of Dragon Canyon eliminates that weakness. This Next Unit of Computing (NUC) variant doesn't revolutionize much. A new processor is the

IMAGE: INTEL

star of the show: a socketed Alder Lake chip, plus some of the platform upgrades that come with 12th-gen Core chips. Otherwise, this NUC looks the same as Beast Canyon, thanks to sporting virtually the same chassis as its predecessor.

But we can't say that it's *just* a processor upgrade. Moving from a mobile chip to a replaceable desktop CPU is quite a move. On paper, Dragon Canyon looks much better equipped to face off against a DIY SFF PC. And that's exactly what we're going to dig into in this article.

DESIGN AND FORM FACTOR

Dragon Canyon is actually the code name for the $1,450 NUC12EDBi9 and $1,150 NUC12EDBi7—Intel's official names for the Core i9 and Core i7 variants of this bare-bones gaming PC. The company sells it as a kit, which means you have to bring your own memory, storage (fave.co/2Z26gQg), and graphics card (fave.co/3DOEuWk). Everything else (the chassis, cooling, and proprietary power supply) is included.

Since Dragon Canyon and Beast Canyon share virtually the same chassis, the concept is exactly the same as before. Inside that eight-liter case, there are just two components to deal with: An Intel Compute Element module (fave.co/3wyaFcl) comes with the kit and houses the memory, storage, and a pre-installed Core i9-12900 or Core i7-12700 CPU. You have to obtain and install your own discrete graphics card, which can be up to two slots thick and a max of 12 inches long. The idea is that you can easily swap either of those elements for a newer replacement down the road.

This Compute Element is the major upgrade in the system. (The chassis has the lone minor change—Intel swapped one of the USB-A ports for USB-C.) The changes are all about cutting-edge tech and speed. Inside is a desktop 12th-gen Alder Lake processor with a completely different architecture from the previous generation (fave.co/3cbahF5) and a GPU slot that supports PCIe 5.0. And at the

A look inside Dragon Canyon's Compute Element.

back, a second ethernet port capable of 10Gbps has been added. That speed may sound ludicrous to most of us in the US, but one PCWorld staff member is living the ultra-fast broadband life (fave.co/3ttwZBD).

Because of that desktop Alder Lake processor, Intel promotes Dragon Canyon as upgradable to next-gen CPUs. They certainly are, but Intel doesn't usually keep a socket around for more than a couple of generations. Realistically, very few people will have reason to upgrade.

The Lian Li A4-H2O has a footprint similar to Dragon Canyon's—it gets its extra volume from its height.

Serviceable hardware is still a plus, though. And in theory having a desktop CPU means less of a compromise in performance compared to a mobile chip. Let's see how that plays out in the benchmarks.

HOW WE TESTED

Rather than try to tackle Dragon Canyon as an independent product, I chose to take a narrower focus. We already know how Beast Canyon stacked up—the short version is pretty damn well. (You can read the full details in our NUCBTMi9 review [fave.co/3iJAI8I] from last July.) That eliminates the need to pick apart Dragon Canyon in fine detail.

Instead, the questions that Dragon Canyon raise are straightforward: How much does it boost performance in CPU-oriented tasks? And how does it stack up against a similar DIY SFF PC (fave.co/3L6p6Io)?

To get a sense of the answers, we'll look at a select handful of benchmarks. Think of these numbers more as a general impression of the hardware rather than as a set of performance expectations.

THE HARDWARE LINEUP

Dragon Canyon

Intel shipped us Dragon Canyon as a bare-bones kit this time, so we supplied our own memory and storage for our NUCEDBi9 review unit. For the graphics card, we used

the same compact Asus RTX 3060 that came with our Beast Canyon review unit last year.

CPU: Core i9-12900 (8 performance cores + 8 efficiency cores, 24 threads)

GPU: Asus Dual O12G RTX 3060

Memory: 16GB HyperX Impact DDR4-3200

Storage: 500GB SK Hynix P31

OS: Windows 11

As you'll see, I couldn't obtain the exact same SSD model as in our Beast Canyon unit. However, the numbers below show that using a PCIe 3.0 (rather than a matching PCIe 4.0 drive) in these particular benchmarks didn't make a difference.

Beast Canyon

Our Beast Canyon review unit came fully outfitted. In the interest of keeping things as even as possible across the board, I used its compact Asus GeForce RTX 3060 with the other test systems.

CPU: Core i9-11900KB (8 cores, 16 threads)

GPU: Asus Dual O12G RTX 3060

Memory: 16GB HyperX Impact DDR4-3200

Storage: 500GB Sabrent Rocket PCIe 4.0

OS: Windows 11

DIY SFF PC

While not an exact match for Dragon Canyon and Beast Canyon in size, this 11-liter system is still close enough to get an idea of how well the two NUCs stack up against a high-performance DIY SFF PC. For the GPU, I again used Beast Canyon's compact Asus RTX 3060 for consistency.

CPU: Ryzen 9 5900X (12 cores, 24 threads)

CPU cooler: Corsair H100i (240mm AIO)

GPU: Asus Dual O12G RTX 3060

Memory: 16GB HyperX Fury DDR4-3600

Storage: TB Corsair MP600

PSU: SilverStone SX700-G

Case: Lian Li A4-H2O

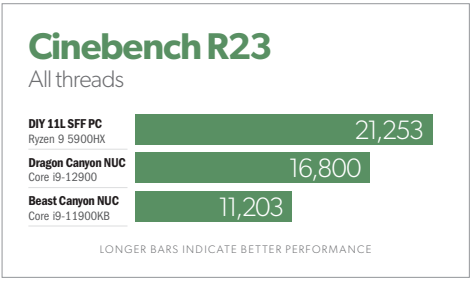
OS: Windows 11

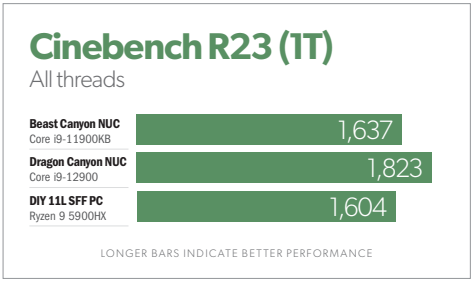
PERFORMANCE

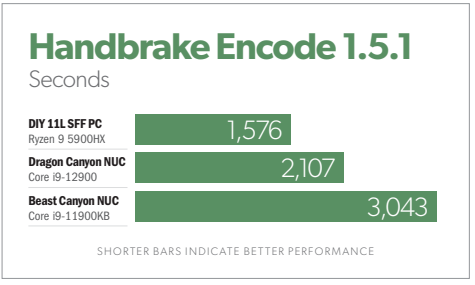
Rendering

First up is Cinebench R23, the latest in Maxon's line of 3D-rendering benchmarks. For evaluation of Dragon Canyon, this test provides insight into performance during in CPU-heavy tasks. The default setting loops the benchmark for 10 minutes, which is what we use for our tests.

Looking at multi-core performance, you can see that going from Beast Canyon's Core i9-11900KB to Dragon Canyon's Core i9-12900 results in a nearly 50 percent improvement. That bodes well for anyone







considering Dragon Canyon. Still, the Core i9-12900 is a bit subdued within Dragon Canyon's confines—we expected numbers closer to those of the Ryzen 9 5900X. In Cinebench R23's single-core tests, however, Intel maintains its single-core performance advantage, just as in full desktop systems (fave.co/3FgvPfZ). That bodes well for gaming performance, as most games don't take advantage of all available CPU cores.

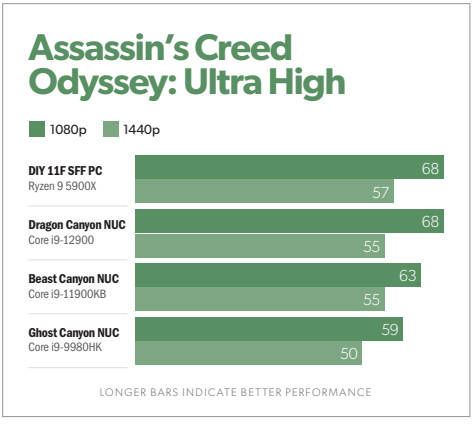
Encoding

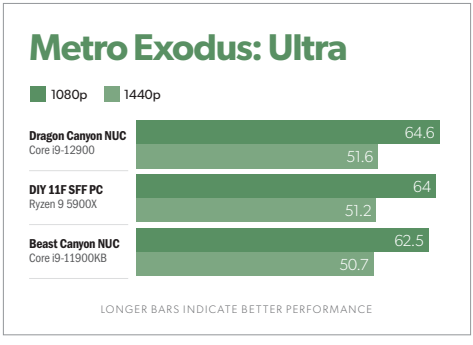
Our Handbrake test involves transcoding a 4K video formatted as an MP4 to an MKV file at the same resolution. This long-lasting encoding benchmark helps round out the Cinebench R23 results, as it provides further context for performance during CPU-oriented tasks.

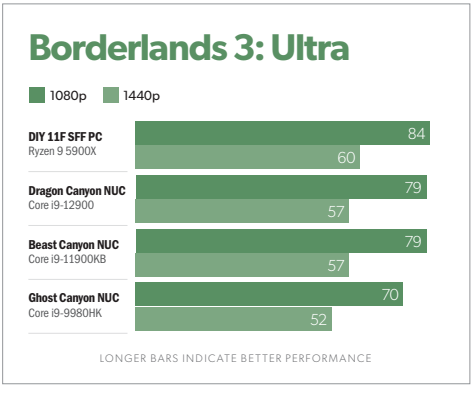
Beast Canyon's Core i9-11900KB performed decently in previous Handbrake benchmarks, though it was still surpassed by other mobile chips. Dragon Canyon's Core i9-12900 decreases the amount of time by a hefty 30 percent, though as you can see, hardcore content creators may still find a DIY SFF PC a better choice if time is money. The Ryzen 9 5900X chews through the file in nearly half the time of the Core i9-11900KB.

Gaming

Spoiler alert: When it comes to gaming, these three systems don't give up much ground to one another on average. That's not a surprise, since games rarely lean on all of a CPU's cores. Instead, single-core performance still often dictates outcomes. Game optimizations can affect results, too. So if you're primarily a gamer and were debating between the ease



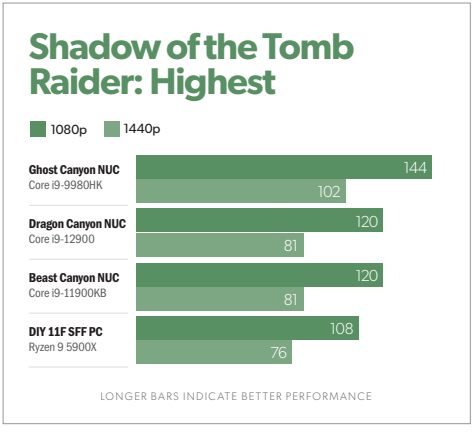




of building in Dragon Canyon or more optimal performance in a SFF build, you fortunately don't have a very tough decision to make at all.

Just have a look at the results from the benchmarks. These AAA titles still punish your graphics card more than anything else, which means your CPU plays less of a role in the final frame count.

Across the board, Dragon Canyon either matches or outperforms Beast Canyon. The real competition here is between Dragon Canyon and the DIY SFF PC, and there's no clear winner in the more recent games. In *Metro Exodus* and *Assassin's Creed Odyssey*, the two systems are deadlocked, and in *Borderlands 3*, the DIY SFF PC has a lead of 6 percent. That edge might sound meaningful, but that lead isn't that much when you're already getting 80 fps.



With some games, you may start to see more of a gap open up, as you can in *Shadow of the Tomb Raider*. But if they're older or less demanding games (which *SoTR* is), it again may not matter much. It all depends on whether you need your framerates to be as high as possible, as you would for a high refresh rate monitor.

Acoustics and thermals

Like Beast Canyon, Dragon Canyon runs fairly quietly. In fact, the DIY SFF PC was generally noisier. Your choice of graphics card (fave.co/3DOEuWk) will influence your outcome, though.

The Dragon Canyon is a solid choice when considering a sub-10L build.

It runs about as warm, too. During CPU-intensive tasks, like a 30-minute run of Cinebench R23's multicore benchmark, Dragon Canyon's Core i9-12900 averaged about 72 degrees Celsius. It crept up higher during gaming benchmarks—I often saw it hovering around 78 degrees Celsius. That's not as optimal as some SFF enthusiasts may like, but given its size and cooling, those numbers aren't unreasonable.

VERDICT

Before Dragon Canyon, Intel's gaming NUCs had an extreme niche vibe. You paid a lot for a cool, well-executed concept—and that was fine so long as you fit the narrow target audience. Otherwise, an alternative was often a better and cheaper choice.

At $1,150 for the NUC12EDBi7 kit and $1,450 for the NUC12EDBi9 kit, you're not necessarily saving money over a DIY SFF build, but you're also not sacrificing performance as with earlier NUCs that leaned on mobile chips. With its socketed chip, Dragon Canyon still retains that incredibly simple, time-saving system for building, while offering flexibility closer to that of a DIY PC. That change makes Dragon Canyon feels like a solid option when considering a sub-10L build, rather than a mere novelty.

Intel Dragon Canyon NUC12EDBi9

★★★★☆

PROS

- Modular design enables simple assembly and upgrades.
- Socketed 12th-gen Alder Lake processor.
- Supports full-length discrete graphics cards.

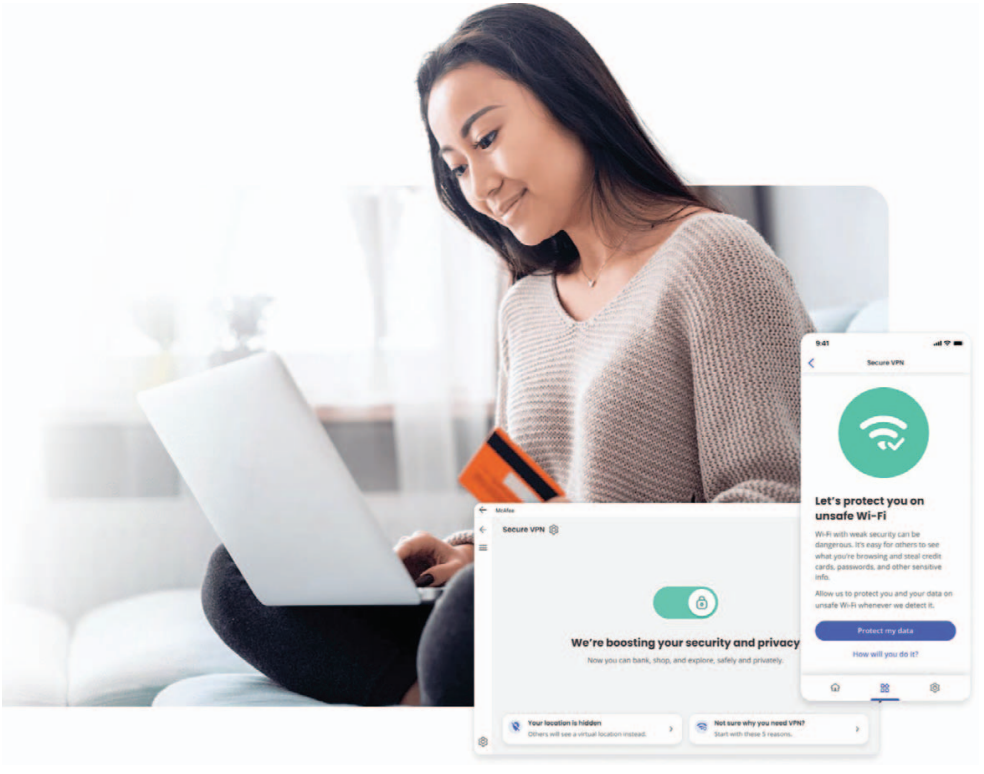
CONS

- Complex case layout.
- Proprietary SFX-size power supply.
- Case can be easily damaged.

BOTTOM LINE

Thanks to its modular design and desktop processor, Dragon Canyon is a solid option when considering a SFF build under 10 liters.

$1,450



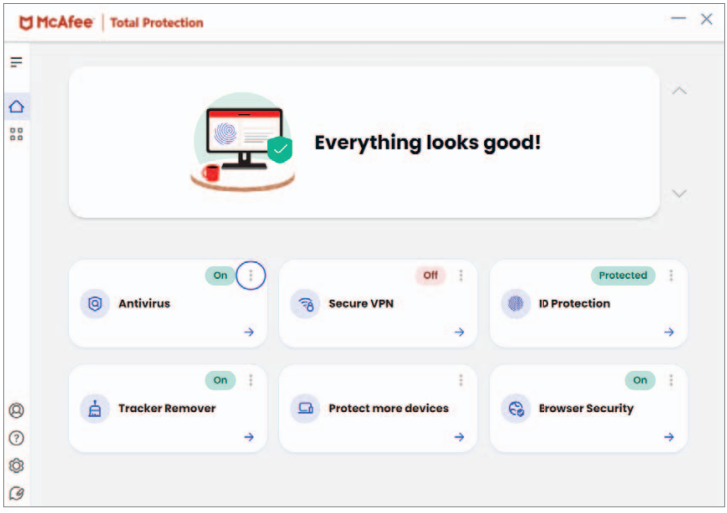
McAfee Total Protection: Top security, but the app needs work

The app design isn't as straightforward as it could be, but overall Total Protection offers a lot of value. **BY IAN PAUL**

McAfee is not the same company it was a few months ago. The longtime antivirus maker sold off its enterprise business in early 2021 to focus on serving the consumer market, including individuals and families. To that end the current suite is all about identity and privacy. As the company sees it, these are the issues that people care about most. Protection from viruses and malware is still important, of course, but from McAfee's point of view the

IMAGE: MCAFEE

focus of new features is currently on identity and privacy, of which device security is inevitably one part. This philosophy is a continuation of where McAfee was already headed the last time we looked at Total Protection.



McAfee Total Protection's dashboard.

For 2022, Total Protection has again adopted a new app design on Windows that builds on what we saw previously. The company has also launched some new features including an Identity Protection Service that assesses how safe you are online, protecting against weak spots, and making it easy to improve protection.

The antivirus maker is also coming off a win from AV-Comparatives (fave.co/3Nc2GHt) after the testing firm named McAfee its product of the year for 2021.

THE SOFTWARE

Similar to its previous iteration, Total Protection has a series of cleanly designed tiles with descriptive labels, as seen above. Like before, there's a banner at the top that can provide notifications, information about features within the suite, and the current status of the PC.

Total Protection has six primary tiles: Antivirus, Secure VPN, ID Protection, Tracker Remover, Protect more devices, and Browser Security. Those should be the main sections of the app, but they seem to actually be a mix of access to features and largely informational tiles. The odd thing is that you get to many of the features by clicking on the four-square grid in the left rail. This reveals key protection features such as real-time scanning, scheduled scans, the firewall, password manager, a file shredder, and so on. Most of them I couldn't find by clicking through the tiles. It's not great when you have multiple but disparate ways to navigate through an app—it adds complexity and confusion.

Diving into the antivirus section, the options are pretty limited. There's a "Run a

scan" button that initiates a quick scan. If you'd like to select a type of scan, the options are "quick" and "full." To scan a specific file or folder, you must use the Windows right-click context menu. That's a common feature in other suites, but many also provide the option to drag and drop a file into the suite window for scanning. That's missing here. There's also a slider button that, when activated, will send suspicious files to McAfee for analysis. This feature is turned off by default, which is great since it lets you decide whether you want to send potentially sensitive files to McAfee.

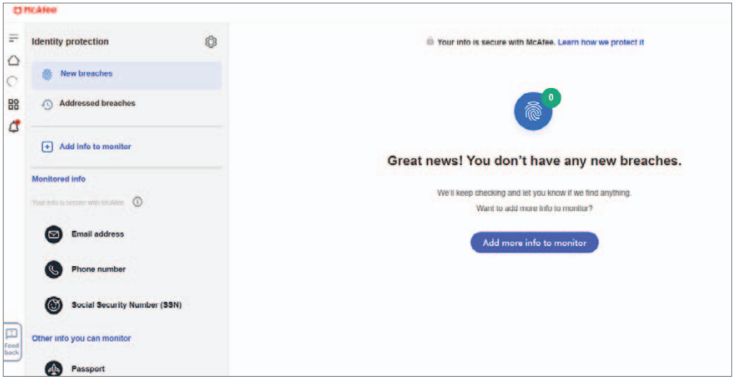
IDENTITY PROTECTION

The ID Protection tile launches you to McAfee's website where you have to log in with your account. Here we have the dark-web scanning feature, as well as McAfee's Protection Score feature, which rates your current privacy and security settings using a variety of factors. The main feature, however, is dark web scanning, which McAfee says it does in partnership with a third party. The company claims that this enables McAfee to alert you to threats much earlier than other security suites. We'll be keeping an eye on this.

At this writing, McAfee offers a wide variety of options to monitor, including email address, phone number, social security number, passport, driver's license, date of birth, tax ID, credit card, usernames, and more. For my tests, I checked for my SSN and email address. McAfee reported no issues with the SSN, but my email address was found in nine breaches.

McAfee lists each breach associated with the found data. Clicking on an item lets you know who discovered the breach, the nature of the breach, and what was taken. It's all very informative and straightforward. McAfee then offers options to change your password for an online account if it's necessary.

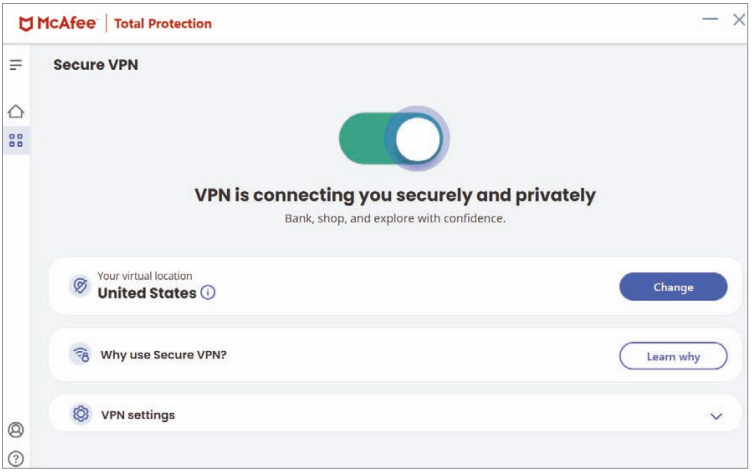
Overall, it was interesting to see. Most of the breaches in my case were of the data broker or advertiser sort, and I didn't knowingly hand over my information to any of the companies that had it. If nothing else, this feature will show you just how freely your



McAfee's Identity protection web interface.

data is being shared with online advertisers and other companies you have no association with.

Still, it's annoying that McAfee has you click through several extra screens for each breach. These included a "congratulations, you checked this issue" message, followed by an animation displaying how your protection score has gone up. After every breach check, McAfee offered a feature that would text me each and every time it discovers my data in a breach. I didn't want to do that as email notifications and alerts through the app are enough. Not one to take no for an answer, however, McAfee offered me the texting option after clicking through every single breach list item. I had nine to go through, and that monotonous clicking got annoying very quickly. It would be better if McAfee asked once, and pointed to where you can activate that feature should you change your mind.



The VPN in McAfee Total Protection.

Moving on to the VPN, McAfee's made an interesting—or annoying—choice for Total Protection subscribers. If you buy it as a one-off without signing up for automatic renewal, you only get 500 megabytes of data bandwidth per month. Sign up for automatic renewal, however, and you get unlimited VPN coverage. To my mind this is unfair. Ultimately, people who do and do not sign up for auto-renewal are still paying the same amount of money to use the suite. Balkanizing paying users into two tiers based on whether they intend to renew or not is very heavy-handed in my opinion.

The VPN itself is easy enough to use. It's built into the suite as before, and offers around 49 country locations. By default, it will choose the fastest location, but you can change that to specify a country. There are also some basic settings such as turning on the VPN automatically when certain conditions are met, like when you're on a network with weak security, or to only turn

it on manually. You can also list trusted networks if you want to use the auto-connect features.

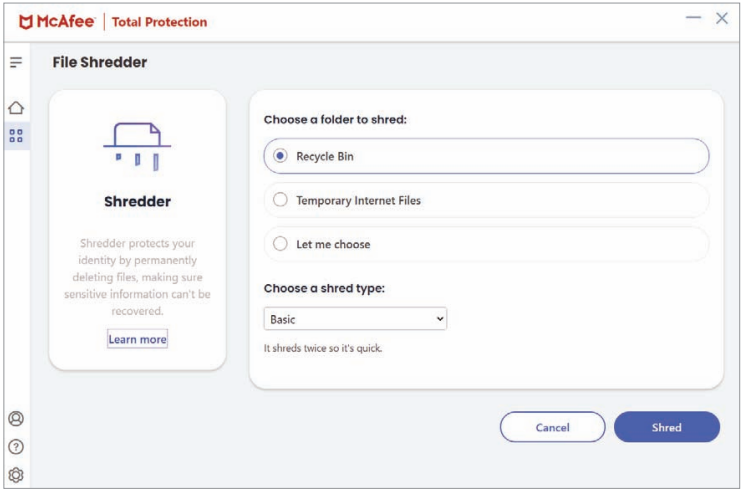
PERFORMANCE

In its latest tests as of this writing, McAfee passed AV-Test's 0-day test with scores of 99.5 percent and 100 percent in November and December 2021 (fave.co/3ui23DU). The widespread- and prevalent-malware test saw scores of 100 percent for both of these months.

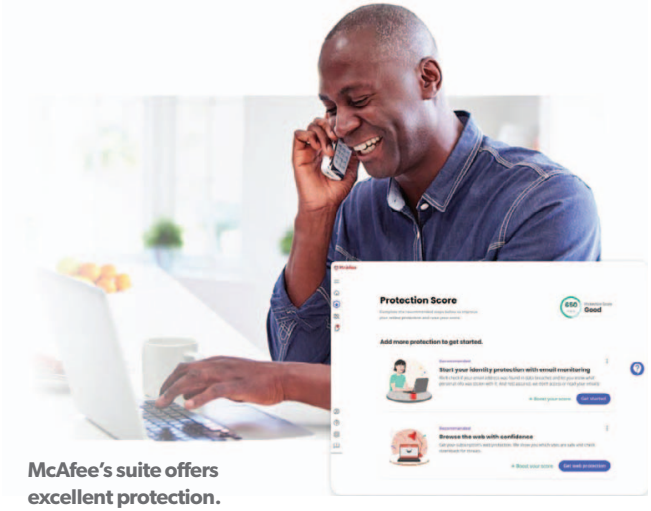
For AV-Comparatives, McAfee earned 99.8 percent in the real-world protection test (fave.co/31ZUMOP) between July and October 2021, with no false positives from 743 samples. For the malware-protection test in September 2021 (fave.co/3wUMGCa), McAfee earned 100 percent again, with four false positives.

Overall, it's pretty clear that McAfee's protection is top-notch and keeping your information safe shouldn't be an issue. One thing to note is that, as with most antivirus suites these days, Total Protection is designed to work while your PC is online, and protection drops considerably while you're offline. The good news is that most threats these days get onto your PC while it's connected to the internet. That is, unless you're in the habit of inserting untrusted USB sticks into your PC while traveling through a remote area with no connectivity, you should be pretty safe when you're offline.

During our in-house tests there were some noticeable dips in performance—nothing dramatic, but having McAfee installed may impact mid-tier to budget machines. During the PCMark 10 Extended test, our test PC dipped by 37 points with McAfee installed and after a full system scan. That dip was largely due to the first run after the scan. The following runs were closer to what we saw before. That initial run is telling, though.



McAfee Total Protection's File Shredder feature.



McAfee's suite offers excellent protection.

There was also a dip in the transfer time, by about a minute, after McAfee was installed. The unzip test was also a bit slower by 45 seconds. The file compression test and the Handbrake test saw no significant dip in performance.

PRICING

McAfee Total Protection is available in several tiers. Total Protection Basic covers a single device for a year with an introductory price of $35 and a non-introductory price of $85. Total Protection Plus covers up to five devices for $40 for a single year for new customers, while the official non-introductory price is $110. Total Protection Premium is $50 for the introductory year and then $130 after that for covering up to 10 devices. Finally, if you want unlimited devices, Total Protection Ultimate costs $75 for new customers and $160 after that.

Non-introductory prices can change, as antivirus companies typically offer all kinds of sales and other inducements to keep you subscribed. Overall, the prices are about on par with what the industry is charging right now.

VERDICT

McAfee is an excellent security suite. It offers high-quality protection, the price is right, performance is good, and there are a few nice extra features such as a VPN, a file shredder, an app update checker, and a home network scanner. I have a few quibbles, such as the VPN bandwidth limit and the design of the app, but overall McAfee is still an excellent choice.

McAfee Total Protection

★★★★½

PROS
- Good protection.
- Nice features like a file shredder and home network analyzer.

CONS
- Mixed impact on performance.
- New app design is a little scattered.

BOTTOM LINE
McAfee Total Protection offers excellent PC protection, decent pricing, and a new desktop design on Windows. We'd like to see the app become a little more streamlined, but for overall value and protection, McAfee is well worth considering.

$45

Acer Aspire 5: An affordable laptop that's enjoyable to use

Looking for value? The Acer Aspire 5's got it. **BY MATT SMITH**

Are you in the market for Windows laptop? Don't want to spend more than $500? Then an Acer Aspire laptop is likely near the top of your list. Aspire laptops routinely take the top slot in Amazon's list of best-selling laptops with some models dipping as low as $369.99. The model we tested for this review is the best of both worlds. It's reasonably priced and it delivers pretty good performance.

Enter the Acer Aspire 5. This laptop packs an Intel Core i5 processor and 8GB of RAM, and is among the most expensive in the Aspire line. But that doesn't mean it's expensive. It has a suggested MSRP of $499.99 and sometimes retails for as little as $479.99. A Windows laptop with a recent Core i5 processor for less

IMAGE: ASUS

than $499.99 might seem too good to be true. Acer certainly makes sacrifices to achieve it. Still, the Aspire 5 is a competent and enjoyable laptop.

The Aspire 5 has a solid and durable feel.

SPECS AND FEATURES

The Acer Aspire 5 pairs an Intel Core i5-1135G7 processor with 8GB of RAM and a PCIe solid state drive. Buyers interested in graphics performance should note the Core i5-1135G7 packs Intel's Iris Xe graphics with 80 execution units and a maximum clock of 1.3GHz. This isn't Intel's fastest integrated graphics option, but it's a big leap up from the Intel UHD graphics found in most 10th-generation Intel Core hardware.

CPU: Intel Core i5-1135G7
Memory: 8GB
Graphics/GPU: Intel Iris Xe
Display: 14-inch 1080p LCD
Storage: 256GB PCIe solid state drive
Webcam: 720p
Connectivity: 2× USB 3.2 Type-A, 1× USB 2.0 Type-A, 1× USB 3.2 Gen 1 Type-C (data only), 1× Ethernet, 1× HDMI 1.4, 1× 3.5mm combo audio, 1× DC-in barrel plug
Networking: Wi-Fi 6, Bluetooth 5
Biometrics: None
Battery capacity: 53watt-hour
Dimensions: 0.71×8.88×12.9 inches
Weight: 3.75 pounds

As mentioned, Acer delivers the hardware at rock-bottom pricing. A quick tour of Amazon shows that alternatives from HP, Lenovo, and Dell are typically more expensive, with most entry-level models slipping between $499 and $599. Acer has an advantage with budget shoppers, but does that hold up under close inspection?

DESIGN AND BUILD QUALITY

The Acer Aspire 5 is what you get if you show up at JoAnn Fabrics and order 14 inches of laptop. They'll roll it out, cut it, roll it back up, and hand it to you in a tall paper bag. It's up to you to iron out any wrinkles once you get it home.

What the laptop lacks in flair is excused by its solid, durable feel. I'll even admit the laptop has something in common with a would-be suitor on *The Bachelorette*: It's

generic, yes, but admittedly handsome. The silver-and-black trim is businesslike and the black keycaps look attractive. There is one quirk. The display lid is slightly more bronze than the rest of the laptop. It's not that noticeable in real life, though the difference is plain in photos.

The laptop comes in at 0.71 inches thick and 3.75 pounds. It's no featherweight, but it will easily slip into most laptop bags and is light enough that you can forget you're carrying it at all. The power adapter is small and will slip into a small pocket on a backpack, messenger bag, or purse.

KEYBOARD AND TRACKPAD

The Acer Aspire 5 has a great keyboard. The key layout is spacious and individual key travel is significant. Key feel is a bit vague but not so bad as to spoil the experience. I spent hours typing and found it to be quick, accurate, and comfortable—so long as the lights are on, at least. The keyboard lacks a backlight. This isn't uncommon in the $500 price bracket, but still worth noting, as it makes the laptop difficult to use in a dark room.

The touchpad surface, which measures about 4.25 inches wide and 2.5 inches deep, is typical for laptops in this price range but cramped next to more-expensive machines with larger touchpads. Windows multi-touch gestures, such as using a five-finger pinch to minimize all open windows, can be hard to use because of the lack of space. The surface feels identical to the surrounding palm rest as well, so my fingers often had to hunt for it.

You'll enjoy the Acer Aspire 5 most when it's on a desk with an external mouse attached. This will let you enjoy the solid keyboard and ignore the lackluster touchpad.

DISPLAY, AUDIO

The Acer Aspire 5 packs a 14-inch, 1080p display with a matte coat. It's basic, but not unremarkable, as it's at once better and worse than expected.

The display is basic but not unremarkable.

Let's start with the bad. The display has a limited color gamut, coming in at just 64 percent of the sRGB scale. Color accuracy is a bit worse than average as well, though not awful. The narrow color gamut and mediocre accuracy saps vibrancy from the display.

The Aspire 5 has a wide range of connectivity options.

The disappointing color performance is paired with a strong contrast ratio of up to 1,300:1, which is respectable for a budget laptop. The brightness is good, measuring up to 290 nits. That's high enough to make the matte display usable in nearly all indoor lighting situations.

Don't forget the display's 1080p resolution. This might seem basic to enthusiasts, but budget buyers often find themselves facing laptops with an inferior 1,366-by-768 display. Going with 1080p makes the Aspire 5 easy to use and ensures crisp, sharp text.

A pair of downward-firing speakers provide the laptop's audio. They're loud at maximum volume and tuned toward a clear, crisp midrange. The speakers are a good match for podcasts, YouTube, and some streaming, as dialogue always stands out. The maximum volume can compete with moderate ambient noise like that from a large fan or office HVAC system.

WEBCAM, MICROPHONE

The Acer Aspire 5 has a basic 720p webcam and a single microphone. Both perform well enough for most Zoom calls but never impress. Those hoping to look crisp in a video conference will need to budget for a decent external webcam (fave.co/3D6gbUs).

The good news? The Aspire 5's top bezel is thick, so most external webcams can perch on top of it without obstruction. The laptop also won't tip over with a heavy webcam such as the Dell Ultrasharp 4K (fave.co/3L6APqn) attached.

CONNECTIVITY

The Acer Aspire 5 uses its thick frame to make room for lots of old-school connectivity. There's a total of three USB Type-A ports (two USB 3.2 and one USB 2.0), one USB 3.2 Type-C supporting up to 5Gbps of

bandwidth, full-size HDMI, Ethernet, and a 3.5mm combo audio jack. The connectivity will be ideal for most buyers. Those looking at a budget laptop will likely use devices that require USB-A and HDMI connections.

Wireless connectivity is the usual combination of Wi-Fi 6 with Bluetooth, both provided by MediaTek's MT7921 wireless LAN card. Wi-Fi performance was reliable across my home. I had no problems connecting a Bluetooth mouse and headphones.

PERFORMANCE

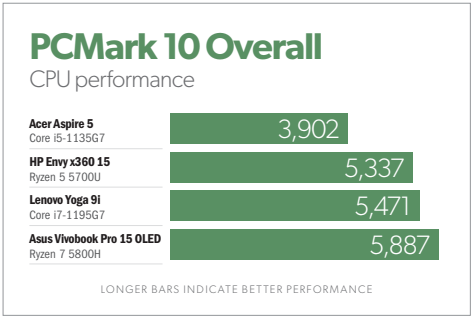
The Acer Aspire 5's Intel Core i5-1135G7 processor promises respectable performance at a low price. It packs four cores and eight threads, and has Intel's Iris Xe graphics with 80 execution units. Acer hasn't slacked on RAM, either, as the laptop packs a healthy 8GB.

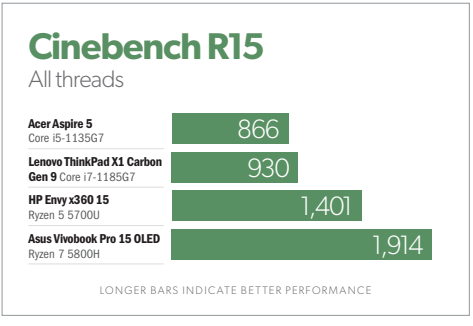
So do the specifications lead to respectable performance?

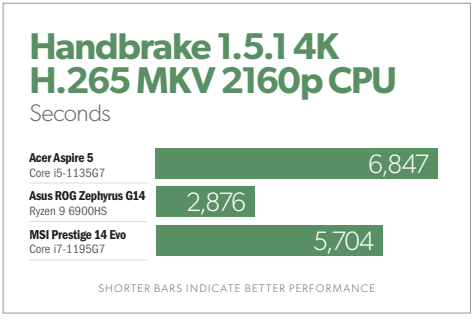
PCMark 10, a general productivity benchmark, starts the Aspire 5 off on the wrong foot with an unimpressive score of 3,902. That this system ends up behind those with faster Intel Core processors is no surprise. However, the real problem is AMD's Ryzen 5 processors, which are found in midrange laptops like the HP Envy x360 15.

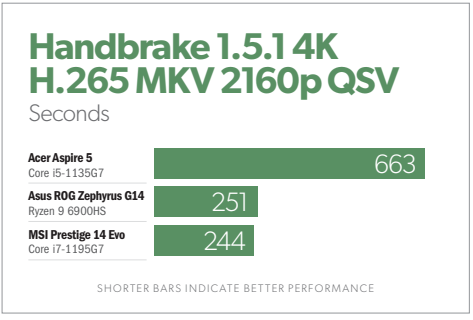
On the other hand, it's worth keeping the price in mind. Most Ryzen 5 laptops are priced well above $499. AMD's Ryzen 3 is more commonly found at $499 and below. The Acer Aspire 5's lackluster score can be excused by the fact that it's by far the least expensive Windows laptop we've tested in recent months.

On Cinebench R15 the Aspire 5 also turns in a fairly anemic result, which, as with PCMark 10, is largely due to the Core i5-1135G7's quad-core design. It can't keep up with AMD processors that pack more processor cores. As with the PCMark 10 results, the Aspire 5's must be kept in mind. Laptops in the Aspire 5's price range often have Intel Core i3 and AMD Ryzen 3 processors with as few as two cores. These will deliver even less impressive results.





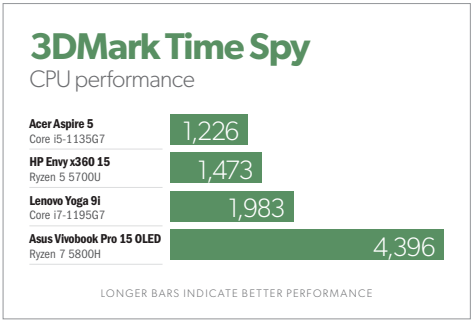




We test Handbrake on Intel processors in two different ways. The first, shown above, relies entirely on raw CPU grunt to transcode a 4K file of the short film *Tears of Steel*. This leads to an outrageously long encoded time of over one and half hours. Fortunately, there's a much better way to encode video on modern laptops. This second test performs the same encode on the same file, but instead uses Intel's Quick Sync and AMD's Video Coding Engine to enhance performance.

Wow. It's a big leap, isn't it?

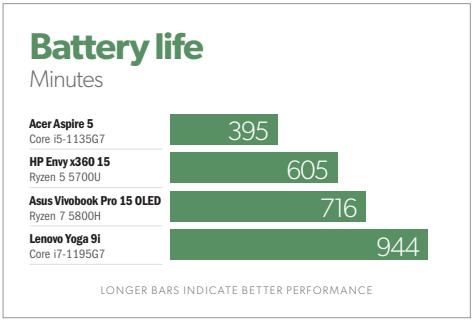
The Acer Aspire 5 does well, performing the encode in just over four minutes. Its score comes in slightly behind the MSI Prestige 14 Evo (fave.co/3Nb6oRV), a 14-inch Windows laptop with a Core i7 processor. The AMD laptop, using VCE, slips in behind both Intel machines, though its encode is still over four times quicker than before.



Intel's Iris Xe graphics power the Acer Aspire 5 to a score of 1,226 in 3DMark's Time Spy benchmark. This is not too far behind the HP Envy x360 15 (fave.co/3tvcULw), which we reviewed with an AMD APU packing Radeon Vega 8 graphics. Gamers will find the Aspire can handle older and less demanding games like *Counter-Strike* and *League of Legends* with no issues. Demanding titles like Control won't be playable at 1080p and 30 frames per second even at low detail.

BATTERY LIFE

Acer ships the Aspire 5 with a 53 watt-hour battery. This is a respectable size for a budget laptop. However, our battery test, which loops a local video file until the battery gives



out, reported only six hours and 35 minutes of endurance. That's not a great result.

Real-world results backed up our test. I used the Acer Aspire 5 extensively for several days and each day pegged endurance at six to seven hours. My workflow consisted of web browsing, writing in Microsoft Word, and photo editing. The battery life is fine for a budget Windows laptop. It can't handle a full eight-hour workday, but it's enough for most cross-country flights and more than adequate for use at a local coffee shop. Budget buyers looking for enhanced portability should turn their attention toward Chromebooks like the Lenovo Chromebook Flex 5 (fave.co/35j565D) or the HP Chromebook x2 11 (fave.co/3D6gSNy).

SOFTWARE

The Acer Aspire 5 arrives with a variety of pre-installed software. This includes Norton Antivirus, Dropbox, Firefox, and a taskbar shortcut to Amazon's main page that simply opens the default web browser (which is still Edge, though Firefox is installed). Additional web links such as Booking.com can be found in the Windows Start menu. While a tad annoying, these extras aren't a problem. They don't hamper performance or generate unwanted pop-ups. Norton Antivirus is by far the most annoying software, but it's easy to uninstall.

VERDICT

The Acer Aspire 5 avoids typical budget laptop pitfalls. Windows laptops sold at this price or below often make extreme cuts. They may have a dual-core processor, just 4GB of RAM, or a tiny 128GB hard drive. This laptop does none of this. It delivers the bare minimum for an enjoyable Windows 11 experience and does so at a price just tens of dollars more expensive than less capable alternatives (including other Aspire models). That makes it hard to beat for $499.

Acer Aspire 5

★★★★☆

PROS
- Affordable price.
- Rugged build.
- Great keyboard.

CONS
- Subpar webcam.
- Annoying bloatware comes pre-installed.

BOTTOM LINE
With its affordable price, decent performance, and robust build, the Acer Aspire 5 is a great budget option for most people.

$499

The fastest VPN: We identify the speediest performers

If you have the need for VPN speed, we've got recommendations about the best choices for you. **BY IAN PAUL**

A lot of people looking for a solid VPN have one primary consideration: the need for speed. Privacy and anonymity are great, but if it means slow-as-molasses connections, most people will opt out in favor of a speed demon. Faster speeds mean a better streaming experience, faster file downloads, quicker website load times, and just a better all-around experience.

Of course, when it comes to speeds there are actually two considerations. Download

IMAGE: DEN RISE/SHUTTERSTOCK

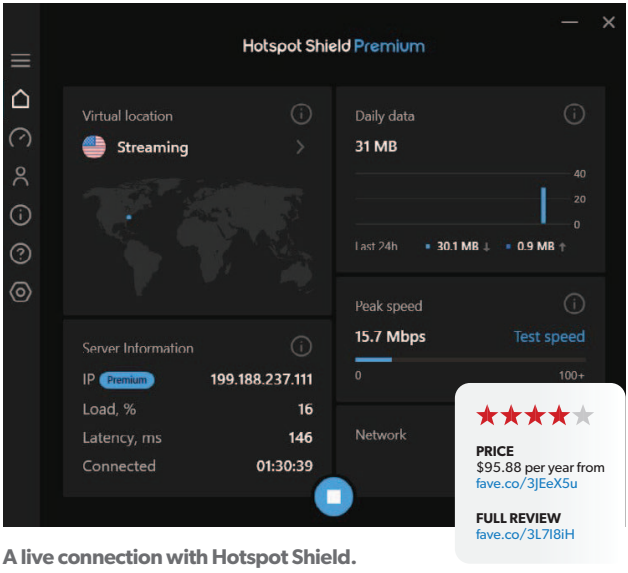
speeds are the primary concern because most people depend on getting data from remote servers as quickly as possible. For some, however, upload speeds for sending data to the internet are just as important. Gamers, for example, need what they're doing to hit servers as quickly as possible.

We tend not to publish upload speeds in our reviews as the interest is more often on downloads, but we're going to look at the upload speeds here. As with our download speeds, we'll focus on the percentage of the base speed that is maintained (or exceeded). The reason is that numbers can differ so wildly from ISP to ISP, device to device, and connection type to connection type that speed retention as a percentage often captures the real experience of most people.

Read on to see the fastest VPN we've found for sending data to the rest of the world, as well as the best choice for upload speeds and the VPN that offers the best speeds while staying as private as possible. (For even more VPN options, check out our comprehensive roundup of the best VPNs [fave.co/3FtTTMs] in all categories.)

FASTEST VPN, PERIOD: HOTSPOT SHIELD

To readers of our VPN reviews, this first choice will come as no surprise. The fastest VPN we've tested is HotSpot Shield, and it's not even a close race. HSS is in a class of its own, retaining 67 percent of the base speed. That is simply a standout score. HSS has its issues, as we haven't been fans of the company's privacy policy, though it's slowly getting better. Of course, it may simply be that to provide the speeds it does, HSS requires the analytics it collects. We can't really say. Regardless, if you're interested in pure download speeds and nothing else matters, then HSS is the one for you.



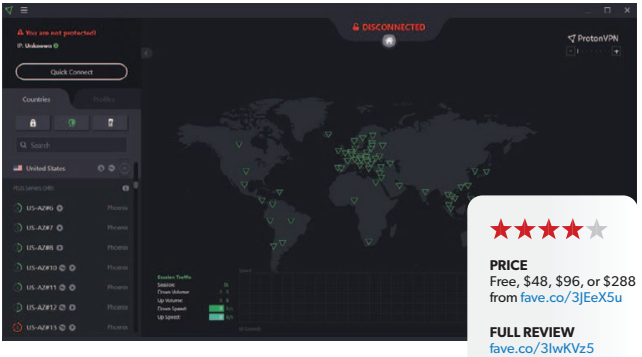
A live connection with Hotspot Shield.

SECOND-FASTEST OVERALL, FASTEST UPLOAD SPEEDS: PROTONVPN

The second place winner is ProtonVPN, which is still quite a ways back at around 57 percent of the base download speed. ProtonVPN is expensive compared to other services, but the privacy policy is better than that of HSS in terms of the amount of data collected from users. It's not as fast as HSS, but ProtonVPN is about as close as you can get when you also want an improved privacy policy.

Upload speeds are a different story. In that competition, HSS doesn't even crack the top 20. Proton, however, is the leader there, retaining more than 80 percent of the base upload speed. If you want something that offers a higher degree of privacy and has top-rated download and upload speeds, then ProtonVPN is the way to go. It also has extra features that may interest some, such as a multi-hop VPN, called SecureCore, support for Netflix and other streaming services, and a few TOR-friendly routers to boot.

Other honorable mentions for upload speeds include Ivacy (fave.co/3Ldj3C9), NordVPN (fave.co/3wX9BwC), ExpressVPN (fave.co/3nthVRR), and Private Internet Access (fave.co/36F5zQq). Any of those VPNs will do the job nicely if upload speeds are a bigger concern than downloads. Ivacy, Nord, and Express are also excellent choices for extra features that go beyond just upload and download speeds, from various locations around the globe. These services also promise features similar to those of ProtonVPN, such as Netflix compatibility, multi-hop VPNs, and more.



★★★★☆

PRICE
Free, $48, $96, or $288 from fave.co/3JEeX5u

FULL REVIEW
fave.co/3IwKVz5

ProtonVPN's Secure Core connections.

THE MOST PRIVATE SPEED DEMON: MULLVAD

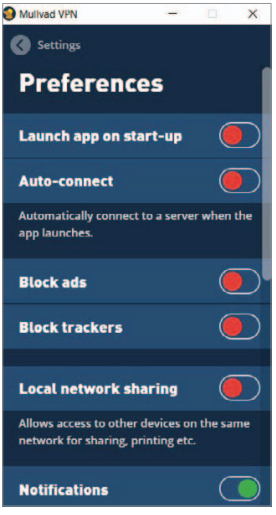
PCWorld EDITORS' CHOICE

If you don't want to compromise on privacy and anonymity, and still want to get solid speeds, then Mullvad is the best choice. This super-simple VPN supports connections via 38 different countries, and it costs 5 Euros per month (around $5.70 at this writing). We've often referred to Mullvad as the "Swiss bank

account" version of VPNs, because Mullvad actively resists obtaining any of your personal information.

Instead of requiring you to sign up for an account with the standard email and password, Mullvad assigns you a random account number. That's it—no birth date or anniversary passwords to give you away, just one number. In our tests, Mullvad was sixth place for download speeds, though its upload speeds were on the weaker side, maintaining just under 60 percent of the base speed.

After Mullvad, we have to turn back again to ProtonVPN since it's so fast, and the privacy promises are good, though you won't get the same amount of anonymity as you do with Mullvad, as email and password combos are the norm.



An active connection in Mullvad for Windows.

★★★★½

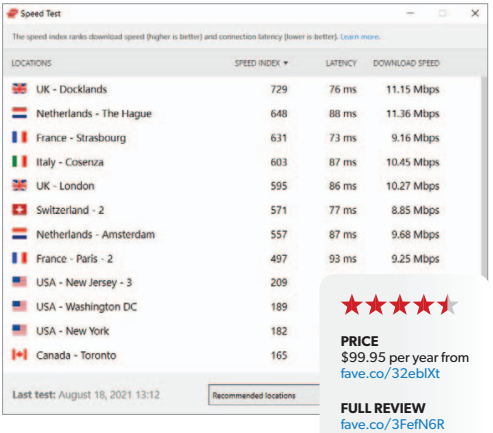
PRICE
€60 (around $68.40) per year from fave.co/32eblXt

FULL REVIEW
fave.co/3Cywibv

THE BRONZE MEDALIST: EXPRESSVPN

PCWorld EDITORS' CHOICE

Our current all-star as the best VPN overall is a good choice for speeds. It ranks third overall in our download speed tests, retaining more than 53 percent of the base speed in our testing. For uploads, it ranks in the top 20, though the differences in speeds there are much slimmer than in downloads. ExpressVPN is one of the more costly VPNs out there at $100 per year. For that money, however, you get solid speeds, a promise to work with Netflix, split tunneling, and a wide range of device support. The app is also pretty easy to use and it has a wide range of country locations to choose from.



ExpressVPN's built-in speed test.

★★★★½

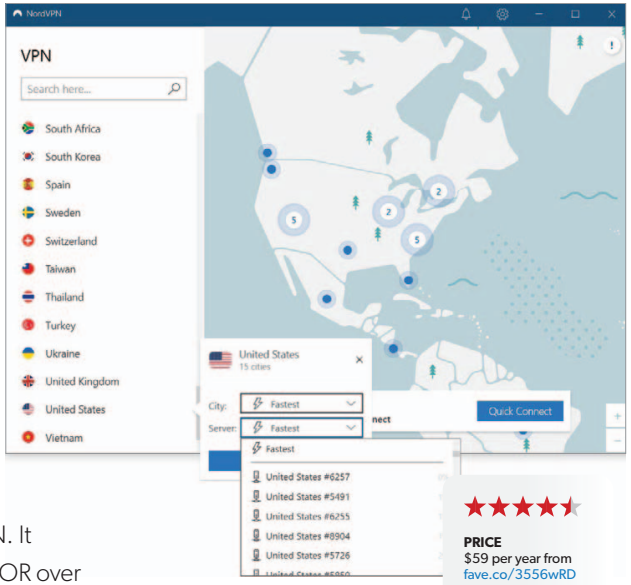
PRICE
$99.95 per year from fave.co/32eblXt

FULL REVIEW
fave.co/3FefN6R

HONORABLE MENTION: NORDVPN

PCWorld EDITORS' CHOICE

Nord regularly appears at the top of many VPN rankings, and it's no surprise to see it here. In our tests, NordVPN retained 49 percent of the base speed, which is plenty fast. It's also inside the top 10 for upload speeds. Of all the VPNs here, NordVPN also has to be one of the most feature packed, rivaling ProtonVPN. It supports multi-hop connections, TOR over VPN, ad and tracker blocking at the server level, and a variety of other options.



Selecting a granular connection in NordVPN.

★★★★½

PRICE
$59 per year from
fave.co/3556wRD

FULL REVIEW
fave.co/3wX9BwC

WHAT TO LOOK FOR IN A VPN

VPNs are a tricky subject. First of all, many security experts often don't have a very high opinion of VPNs. That's due in part to shenanigans from early VPN companies, as well as the fact that the use of a VPN is based entirely on trust. You have no way of knowing for sure if your service is doing what it says it's doing, hence the need for that trust. VPN companies are going a long way to improve the level of trust with third-party audits and by upholding their privacy promises in court.

So how can you put your trust in a VPN? There are a few steps you can take. First, make sure you know who is behind the company. It's easier to trust a company if you know where they are located and who's running the show. Next, consider VPNs that aren't in unfamiliar locations half a world away. You can object to the so-called "Fourteen Eyes" all you want, but if you're using a VPN to access Gmail, Facebook, and Twitter, then far more sensitive information than your browsing history could potentially be exposed under force of law.

Once you're comfortable with the company providing your service, it's time to

see what kind of information it's logging from your activity, if any. Some VPNs promise to log nothing, some take minimal data to improve their networks, while others log a surprising amount. Ideally, you want a VPN that logs as little data as possible, especially when it comes to which websites you're visiting—though if speed is your primary concern, you may be able to forgive HotSpot Shield for collecting the TLDs you visit on an anonymized basis.

Next, you may want to consider how many servers a VPN has. The more servers there are, the less chance of congestion and reduced speeds. It also makes it easier to switch servers in the same country when you need to for viewing Netflix or other needs.

Finally, you want to be a paying customer with a VPN when possible. Free and paid VPNs can have differing privacy policies, and free VPNs often have paltry data limits that aren't helpful. If you only need a VPN for a limited time, many services have month-to-month commitments at prices ranging from $5 to $10.

HOW WE TESTED

Testing is pretty simple. We test the speeds in five countries on a given day, testing each country location three times. These countries are typically the U.S., the U.K., Germany, Australia, and Japan, but that can change depending on the locations the VPN offers and if there are any unique testing requirements.

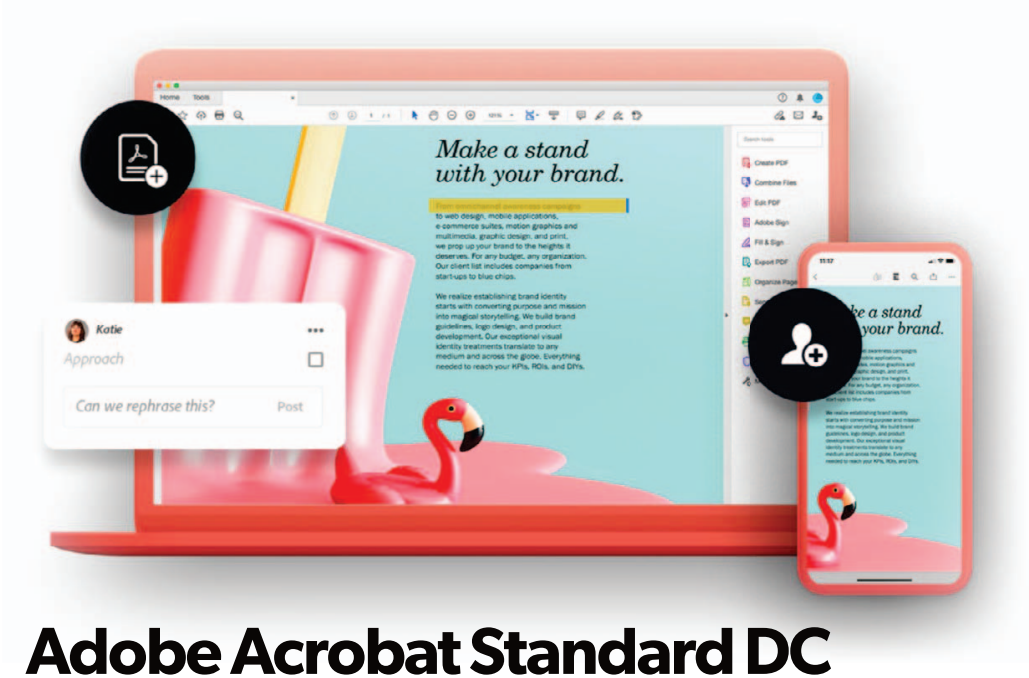
The daily speeds are averaged together to get a daily average speed. We test a total of three days at different times of the day to account for any variation. Then we take the average of each testing day to get an overall average. That overall average is then expressed as a percentage of the base speed. That way the test results provide a sense of how much speed a VPN retains versus hard numbers, which can vary based on internet service providers, routers, and other equipment, time of day, and so on.

FINAL POINTS

After you go down the speed rankings behind HSS and ProtonVPN, the speeds start to group up into tiers pretty quickly within the top 10. ExpressVPN, NordVPN, and Perfect Privacy (fave.co/3JzewcP) make up the third tier after the top two leaders. Then Mullvad, Surfeasy, Private Internet Access, Air VPN (fave.co/327FLe2), and HMA (fave.co/3wtwPw2) round out the top 10 for download speeds.

The drop-off for upload speeds is much more gradual, making any of the services mentioned in the upload section a good choice if this is your primary concern.

Speeds aren't the only consideration one can have for choosing a VPN, but for many people it's the primary one. We'll also be looking soon at the best VPNs for a variety of other uses, including streaming, torrents, mobile, and more.



Adobe Acrobat Standard DC vs. Adobe Acrobat Pro DC

Here's what you need to know before purchasing Adobe's paid PDF editor.

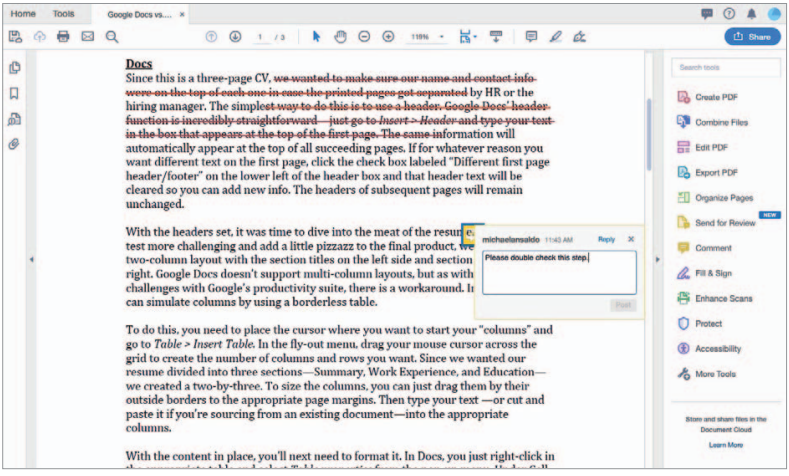
BY MICHAEL ANSALDO

Adobe Acrobat remains the gold standard for PDF editors—as well as the most expensive. Given the cost of upgrading from Adobe's free Acrobat Reader, it's worth familiarizing yourself with the differences between the company's two paid products for individuals: Adobe Acrobat Standard DC and Adobe Acrobat Pro DC (which cost $12.99 a month and $14.99 a month, respectively, with an annual commitment). While both versions will get you the desktop software, access to Adobe Document Cloud services for storing and sharing files, and an Adobe Sign subscription to sign and collect legal electronic and digital signatures on any device, there are some differences in features and capabilities that may make one or the other better suited to your needs.

HOW THEY'RE SIMILAR

It's easiest to start with how Acrobat Standard DC and Pro DC are similar because many of the most essential features are available in

IMAGE: ADOBE

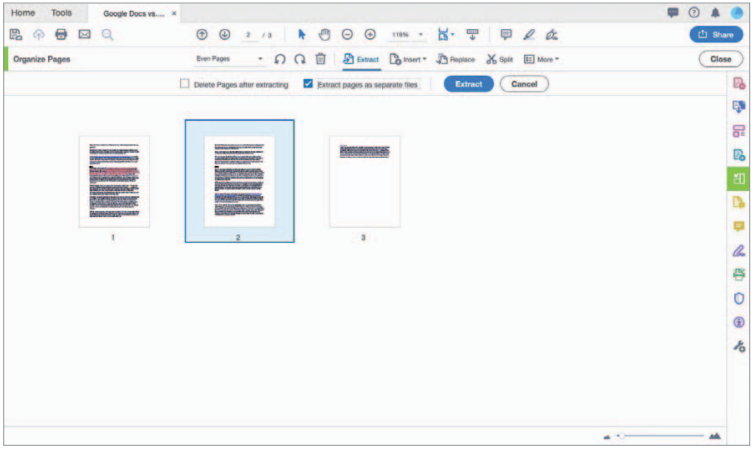


Both Acrobat Standard DC and Pro DC provide essential editing tools like markup and comments.

both versions. For example, both Standard and Pro enable you to create PDFs. That includes converting documents and images to PDF, creating PDFs from any application that prints, combining multiple documents and file types into a single PDF file, and turning webpages into interactive PDFs with live links.

Both versions also support basic editing of PDFs. You can add, delete, reorder, and extract pages; edit images and text; permanently remove sensitive information; add page numbering, bookmarks, headers, and watermarks; and convert PDFs into Microsoft Office files and a variety of image formats.

Acrobat Standard DC and Pro DC both allow you to share and collaborate on



Both Acrobat Standard DC and Pro DC let you insert, delete, reorder, and extract PDF pages.

documents as well. You can share any document—as an email attachment or as a link to the file in Adobe Document Cloud—as well as add comments and markups, fill in forms, collect e-signatures, and receive real-time activity notifications.

HOW THEY'RE DIFFERENT

Once you move beyond the basics, there are a few key differences between Acrobat Standard DC and Pro DC that may influence you to decide on one over the other.

Searchable scanned documents

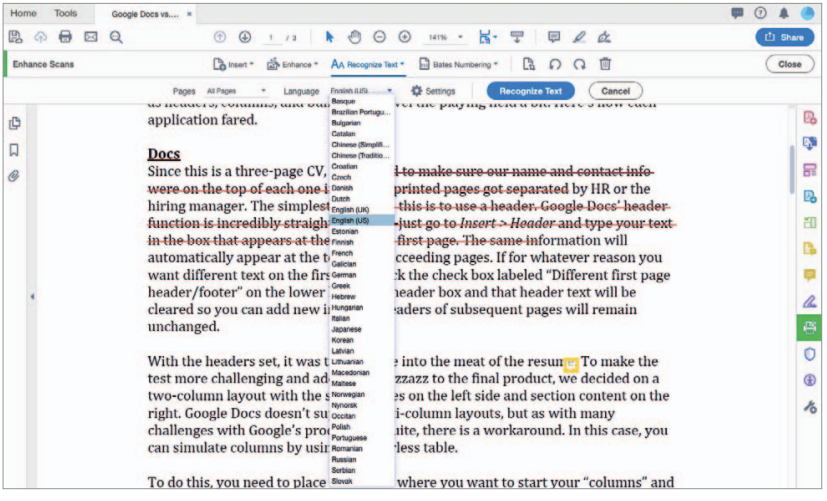
A critical feature for many users is the ability to convert scanned paper documents into searchable, editable PDFs. For that, you'll need Acrobat Pro DC. It can recognize text in a variety of languages, allowing you to easily find and edit information in the document.

Enhanced editing

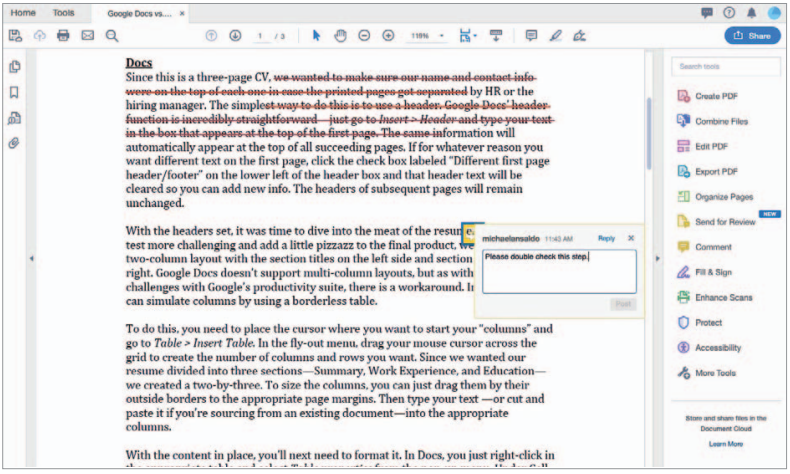
While Acrobat Standard DC includes enough editing capabilities for most personal and business use cases, Acrobat Pro DC adds a few that might be required in certain scenarios. For instance, Pro DC gives you the option to redact sensitive information from documents when you want to keep it hidden from particular viewers, rather than only permanently remove it as Acrobat Standard DC does.

Acrobat Pro DC also lets you add audio, video, and interactive objects to PDFs. If you work with legal documents, Pro DC is the only version that enables Bates numbering.

Perhaps most important, Acrobat Pro DC extends editing to your mobile devices, allowing you to edit text and images; reorder, delete, and rotate PDF pages; and fill and e-sign PDFs on your tablet or phone.



You need Acrobat Pro DC to create searchable and editable text in PDF files.



You can compare versions of the same document in Acrobat Pro DC and view a summary of changes.

Document comparison

If you send a lot of documents out for review, you need an easy way to make sure all requested changes have been made. Only Acrobat Pro DC lets you compare two versions of a PDF side by side. You can even filter the types of changes you want to view and print a comparison report and summary of changes.

Operating system support

This will be the deciding factor for Mac users. Only Acrobat Pro DC is compatible with both Mac OS and Windows; Acrobat Standard DC is available for Windows only.

Pricing

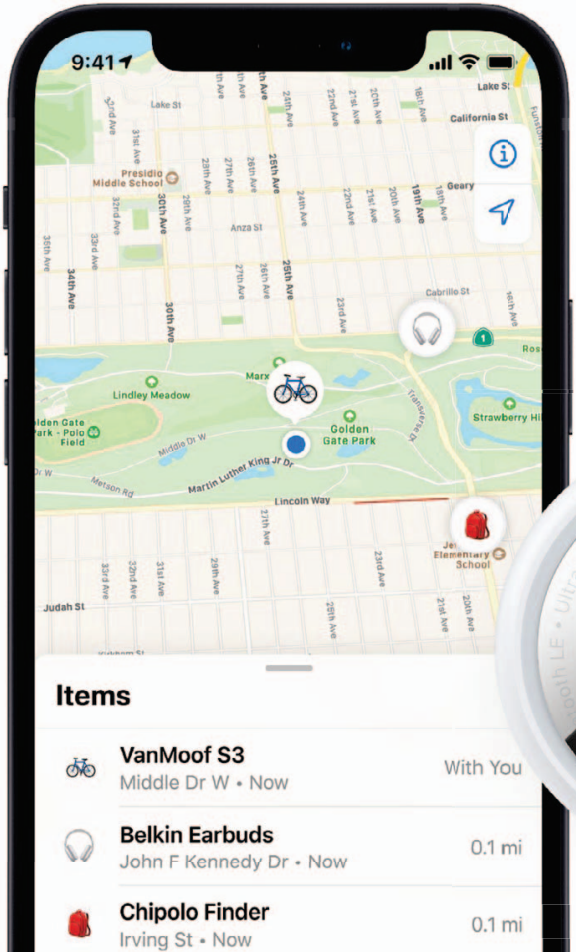
Both versions are offered as monthly or yearly subscriptions, and not surprisingly, you pay a bit more for Acrobat Pro DC's extended capabilities. A monthly subscription to Acrobat Standard DC (fave.co/3Fj1rld) costs $23 per month. If you make an annual commitment, it's knocked down to $12.99 per month, or $155.88 billed annually. A monthly subscription to Acrobat Pro DC (fave.co/3Fj1rld) runs $25 per month, while an annual commitment reduces that to $14.99 per month, or $177.88 billed annually.

WHICH ONE IS RIGHT FOR YOU?

If you're a Windows user and your PDF use is limited to creating, editing, and sending documents, Acrobat Standard DC has more than enough functionality for you. Acrobat Pro DC is best reserved for business users and those with particular needs, like protecting sensitive information. It's also the only choice for Mac users.


WHEN THE GAMES BEGIN.
NEVER GIVE UP
UNTIL THEY BUCKLE UP.
VISIT SAFERCAR.GOV/KIDSBUCKLEUP
NHTSA
www.nhtsa.gov
Ad Council

I USED APPLE AIRTAG TO TRACK MY WIFE AND KIDS: HERE'S WHAT I LEARNED



CREEPY? YES. BUT I DON'T THINK APPLE NEEDS TO NERF ITS TRACKERS.

BY GORDON UNG

An Apple AirTag was used to stalk a *Sports Illustrated* model (fave.co/3qy2DMN). Thieves are placing AirTags on cars (fave.co/36M0xlm) to track them home, where they can later be stolen—or you could be tracked yourself (fave.co/357ph70). If you're like me, you may have been freaked out by those headlines recently pushed your way. But since a lot of headlines can be overblown, I decided to experiment with an AirTag to see if they are justified—by tracking my wife and kids.

Full disclosure: I'm an Android user and I've used Tile devices for some time. When the headlines started to accumulate recently, I heard Apple fans throw out whataboutisms (fave.co/3wuIUCu), saying, "Tile does it too! And Samsung!"

I dismissed Tile as being much of a threat since in my experience Tile *didn't* work more often than it did. How can a technology that can't find my misplaced portable SSD (fave.co/3n5NIMC) inside my home be used to track someone 20 miles away? Still, I decided to include a Tile Pro (fave.co/3LfM4Nd) (a 2020 model with a new battery) and a shiny new AirTag (fave.co/37NwHgC) in my testing. I did this with my family's knowledge, and I also followed them via a phone-based GPS tracking app to compare that with what I was seeing in the Tile and Apple Find My app.

Before we go too far, you need to know how the AirTag and Tile Pro work. Both are

Both the Tile Pro and the AirTag emit a Bluetooth beacon every few minutes via radio frequencies.

very simple devices that emit a Bluetooth beacon every few minutes via radio frequencies. That beacon reports the last location of the phone, tablet, or IoT device that it pinged.

For Tile, any other phone running the Tile App or any Amazon Sidewalk device (Echo and so forth) will report if it has received the beacon and relay the information. The AirTag does the same but with the key difference of a billion iOS devices that it can ping. The trackers do *not* contain GPS locators, but instead rely on the phone or Amazon Sidewalk device's reported location. There is also a short-range, high-precision locator feature on newer trackers, but that's only when you're very close to the tag. Most of the coarse location information is done using Bluetooth.

If the only thing someone wants to know is where you live, Apple's AirTag is frighteningly effective.

With all that out of the way, I tracked my family with my AirTag and Tile Pro in a variety of scenarios.

TRACKING DEVICE FOR A TAIL: NEAR USELESS

For my tests, I tested with the trackers inside the car in a cup holder. And, uh, also taped them to the bumper to simulate my lifelong fantasy of being PI Jim Rockford (fave.co/3NjtGVF) tailing someone.

I've actually tried to tail someone the old-fashioned way as reporter and lost them within a few minutes. If I had planted an AirTag or Tile Pro on their car, it wouldn't have helped me.

The AirTag and Tile Pro simply don't update information often enough nor do they come into contact with other devices at the right time to be useful. When the location is updated, it's usually so out of date the actual person might be a mile or miles away. Also, at freeway speeds you'll just never receive any updates most of the time.

TRACKING YOU TO YOUR HOME: SCARY, SCARY EFFECTIVE

Actively tracking you at freeway speeds is pointless, but if the only thing someone wants to know is where you live, Apple's AirTag is

scary effective. Indeed, so is the Tile Pro. Again, my experiences with my Tile Pros have been pretty much hit or miss for finding lost stuff in my home. So I was quite surprised to see the Tile Pro worked reasonably well as a tracking device.

I had expected the porous Tile network to be so ineffective that the Tile Pro would provide no useful information at all. For example, in a 20-mile radius of my metropolitan home, the app reports roughly 5,000 Tile users. That's 5,000 people running the app that can spot a missing Tile in a city of 400,000. That's not a lot, but its partnership with Amazon appears to have made a difference. Any Echo or Amazon doorbell, security camera, or other Bluetooth-enabled device can also spot the Tile and report its last location. It works well enough that it feels like a Tile Pro planted on your car could at least get someone within a few blocks of you. In my testing, the Tile Pro was spotted by a neighbor's house 150 yards away.

I'm confident Apple's AirTag could track you within a house or two of where you end up thanks the massive network of iPhones. Find My, for example, reported that my AirTag was located inside the neighboring house, where I know the occupants use iPhones.

AS A WAY TO STALK SOMEONE WALKING AROUND: SCARY EFFECTIVE

The *Sports Illustrated* model who was tracked said that the culprit planted an AirTag in her jacket to follow her as she walked home. To simulate that experience, I placed both the Tile Pro and the AirTag in my daughter's backpack and watched her movements.

The Tile Pro, again, did far better than I expected in a dense metropolitan area, where there are apparently just enough Amazon Sidewalk devices and Tile-enabled phones.

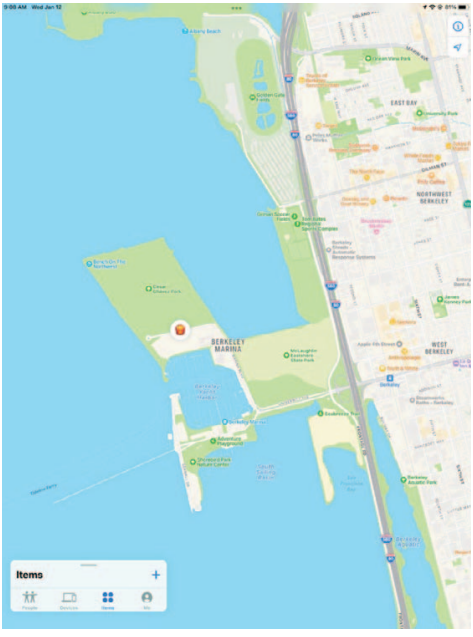
If you lose your AirTag, the vast Find My network will track it down for you.

But it paled in comparison to the AirTag, which gave me updates on my daughter's location that let me pinpoint her location within perhaps 25 feet to 50 feet and seemingly updated every time I checked. The reason? My daughter has a Tile but the app is no longer active because she became frustrated with it just not working. If she had the Tile app running, the location updates could have been better. But she uses an iPhone that the AirTag would use to update its location.

Again: An AirTag doesn't have GPS. It relies on your phone to report its location back to you. In a dense area, it's unlikely you're ever out of radio range of an iPhone reporting that AirTag's last location.

THIS IS SCARY—APPLE (AND TILE) NEED TO DO SOMETHING!

After seeing just how scary effective the AirTag is (and to an extent, Tile as well), you might think I'm for Apple potentially Nerfing its use further. In fact, some would probably call for banning the technology outright. That's an understandable knee-jerk reaction many people would have after seeing the latest 60-second TV news broadcast or newspaper story on an AirTag "used to follow someone home!" We shouldn't make light of these occurrences and they are a legitimate problem. But they are also legitimately criminal activities too. Many states have laws that prevent electronic tracking of a person



The AirTag's location updated every time someone with an iPhone walked or drove by the car it was located within.

without their knowledge. I recommend you read Macworld's excellent guide on how to find and neutralize unwanted AirTags (fave.co/3iwkFdl) that may be tracking you.

After a few days of stewing it over, though, I've come to realize that the AirTag is far more likely to be useful as a tool that works in your favor should a crime occur, rather than it being used against you.

The latest FBI crime stats report that 721,885 cars were stolen in 2019. The National Insurance Crime Bureau shows that 53,111 motorcycles were stolen in 2020. Your

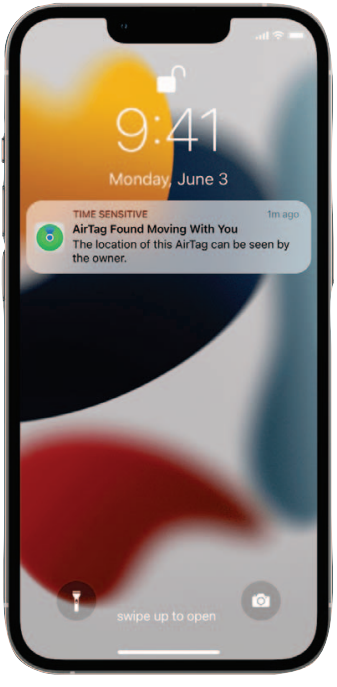
odds of recovering a stolen car seem to range from 50 percent to 80 percent depending on the state and the reporting organization. Getting a stolen motorcycle back is pretty rare as well. Your bicycle or stolen lawn mower? Forget about it.

What I do know from living in a high-crime metropolitan city is that a stolen car either gets stripped down for parts, lodged against an abutment, or abandoned in an area where someone else decides to strip it for parts or use it as a bathroom.

If you're lucky, it just sits on the street until it accumulates enough tickets and a towing agency takes it away, leaving you to pay several thousand dollars in impound fees. Maybe you'll get your Creedence Clearwater Revival tape back, but in the end, the odds of getting your car returned—especially in a timely matter—are terrible. You could pay a few hundred dollars for a great system such as a LoJack, but are you really going to LoJack a jalopy?

But for the low price of $29, you can basically tag your car, bicycle, motorcycle, outdoor grill, or generator and track it down should it ever get "misplaced." In fact, it's already popular to tag pets with AirTags to track them down should they run off. Frankly, I wouldn't mind it if someone could figure out a way to make an AirTag withstand the heat of a catalytic converter so thieves and the location of the shops that buy those stolen catalytic converters could be reported to the police.

Apple and Tile are likely uncomfortable with the trackers being used this way since they're always thinking about the liability that could come their way. Apple has already made some changes to start to address AirTag stalking concerns (fave.co/3LbHcsx), and those improvements may wind up in iOS 15.4 (fave.co/3LbHDDb) very soon. Good! I don't care what Apple or Tile think, though, because despite the months of scary headlines—this one included—I've come to realize the AirTag and Tile are very powerful tools that can also be used for good, and not just abused for evil.



If you are being monitored by an unknown AirTag, this message will appear.


YOU MAKE MONEY.
NOW MAKE IT WORK FOR YOU.
Learn how to save for your retirement at **WeSaySaveIt.org**.
WE SAY $AVE IT
AARP
ad COUNCIL

DON'T FALL INTO THE FREE CLOUD STORAGE TRAP WITH A NEW PC

THOSE GIGABYTES YOU GET FROM DROPBOX, ONEDRIVE, OR GOOGLE DRIVE WON'T STICK AROUND FOREVER UNLESS YOU PAY. **BY MICHAEL CRIDER**

IMAGE: RAWPIXEL.COM/SHUTTERSTOCK


Cloud
Storage
Upload
Recent
Share

You should exercise some caution before uploading your data to the cloud.

Cloud storage is a big business, and it's sold by the same corporations that make components of the laptops that are stocked on store shelves all over the world. So it makes sense that they're giving away "free" cloud storage with the purchase of new PCs. But exercise a smidgen of caution before you load up a hundred gigs or so of cloud space with your essential documents or precious memories. Unlike the soupçon of free storage given away with new accounts at places like OneDrive, Dropbox, or Google Drive, the larger freebies that are associated with a new laptop purchase (fave.co/3qL4oHf) come with a time limit.

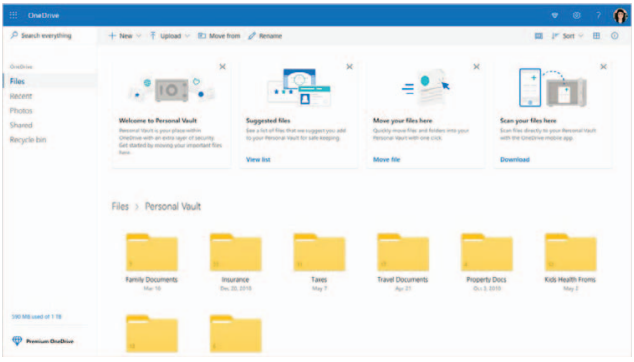
This concept will be familiar if you've ever accepted a free trial for, say, Norton Antivirus after booting up a new laptop. After a year or so, the freebies disappear unless you pay. But while antivirus software (fave.co/3CnDHuk) is somewhat redundant on modern machines (built-in solutions like Windows Security [fave.co/3tXSvPP] are good enough for many people), cloud storage is so useful and so in demand that users will be caught in a lurch if they use it for a while and aren't ready to pay up.

WHICH CLOUD STORAGE SERVICES OFFER FREE STORAGE BOOSTS?

Here's a short breakdown of the larger cloud storage providers and which ones will give

you freebies when you purchase a new machine.

Dropbox: Dropbox doesn't have hard-and-fast promotions in place at all times, but will infrequently offer boosted storage on accounts when you sign in from a new laptop made by a promotional partner. In the past these have included Asus, Acer, Dell, HP, and Lenovo. Depending on which vendor you bought from and when, the free boost to your storage may have been anywhere from 20 to 100 gigabytes—a pretty huge increase over the standard 2GB of space on a free account. All of these promotions have been for one year after registering.



Microsoft gives a 1TB storage boost to Microsoft 365 subscribers.

OneDrive: Microsoft has given away temporary 100GB OneDrive storage boosts by logging in on Samsung-branded smartphones, and 200GB on some Surface hardware purchases. OneDrive also automatically gives an impressive 1 terabyte storage boost to any user who's subscribed to Microsoft 365 (fave.co/3tAipZ7). This free boost disappears if you stop paying, becoming inaccessible at the end of the monthly billing cycle.

Google Drive/Google One: Google typically offers a 100GB Google One (Google Drive) upgrade (fave.co/3Li4ixX) to anyone who purchases a new Chromebook or other Chrome OS–powered machine, ending after one year. Previously, buyers of Pixel-branded Android phones could also get unlimited full-quality photo backups in Google Photos (fave.co/3izENf4). Google Drive offers an unusually roomy 15GB of free storage for all users, no purchases necessary.

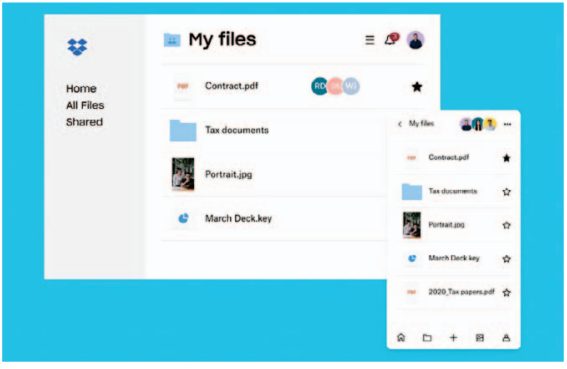
Other cloud storage companies may have offered similar deals for new purchases of computers and phones, but they all generally follow the same format.

WHAT HAPPENS WHEN YOU STOP PAYING FOR CLOUD STORAGE?

If you decline to subscribe to cloud storage after the initial free period (or you cancel the subscription before you're charged for it), it's not the end of the world. Typically the service won't delete your files immediately—after all, they want you to pay to access them. The different cloud storage companies have

different terms on what you're allowed to do with storage in excess of your paid tier.

Dropbox: Once your storage limit is exceeded or your subscription ends, Dropbox keeps your files on its servers (fave.co/3wErXnY), in addition to backups of deleted files for 30 days. While you can access and download any files already uploaded, you cannot upload new files, and Dropbox will not automatically sync files to your Dropbox folders or apps.



Once your subscription ends, Dropbox will keep your files on its servers for 30 days.

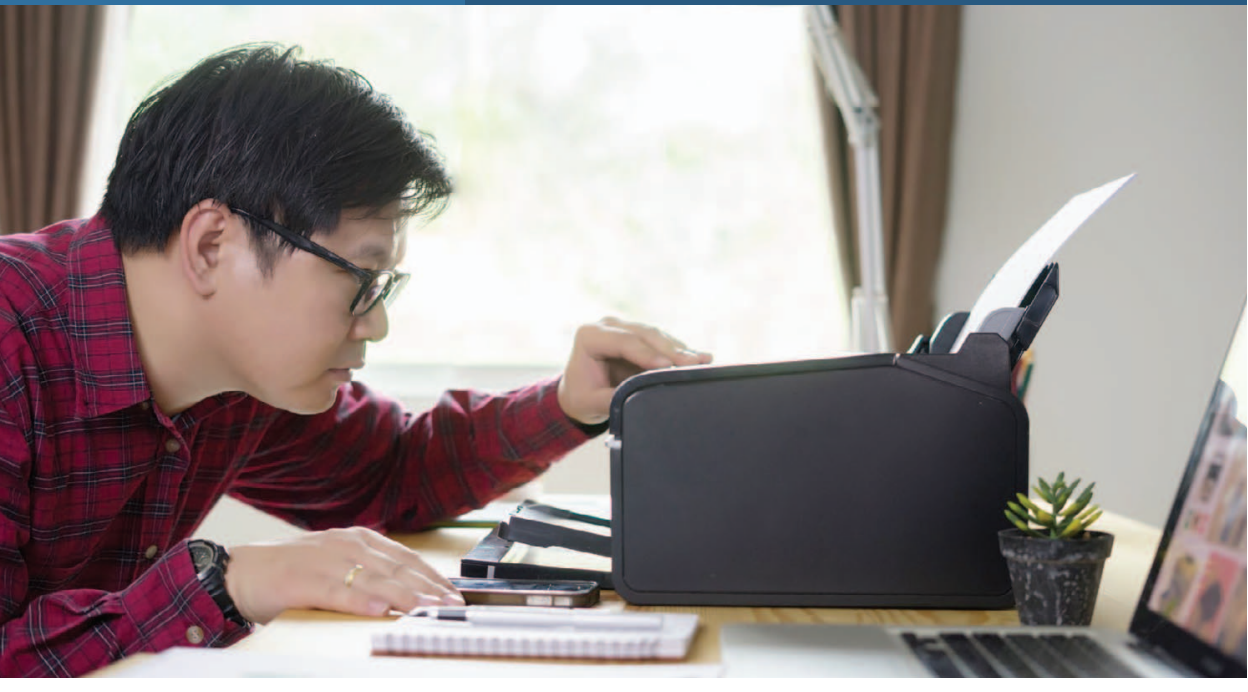
OneDrive: Microsoft's a little more strict when it comes to OneDrive. When you end a subscription or a free trial offer and still have files in excess of the new storage limit, your OneDrive account becomes "frozen" (fave.co/3iANlg8), and you won't be able to access any of those files. You can log in to OneDrive to temporarily unfreeze it, after which you get a 30-day grace period to download any or all files on the account. After 30 days, if your files still exceed the 5GB free storage limit, your account may be deleted and all files within it discarded.

Google Drive: If you have exceeded your limit for storage in Google Drive (and Google One), or if you allow a temporary boost to expire, you can no longer upload new files via Google Drive or Google Photos. Perhaps more alarmingly, you *also* won't be able to send or receive email in the associated Gmail account (fave.co/3wHCP4m), or create or share new documents in Google Docs, Sheets, Slides, and associated tools. You can alleviate this by logging in to Google Drive and deleting files until you're once again below the limit. Google gives users a two-year grace period for accounts over their storage quota, after which their data may be deleted.

All that said, it's not as if these services are doing anything underhanded…they're just hoping that you'll get so used to the convenience of their always-on, accessible-anywhere systems that you feel like paying after a year or so. And for a lot of people, it's worth the money. But with so many different services on offer (fave.co/37NThWs) and so many different tools between them, you might want to shop around instead of sticking with whichever one gave you a freebie with your new machine.


INVEST IN YOUR FINANCIAL INDEPENDENCE.
YOUR RETIREMENT. YOUR RULES.
Learn how to save for your retirement at **WeSaySaveIt.org**.
WE SAY $AVE IT
AARP
ad COUNCIL


ad COUNCIL
American Lung Association.
I think it's just vapor. It won't hurt my kid like cigarettes, right?
The vapor that's inhaled from e-cigarettes contains harmful chemicals that can cause irreversible lung damage.
And e-cigarettes have nicotine, a toxin that's addictive and can change your kid's brain. Those are the facts.
Talk to your kid about vaping. Get the facts at
TalkAboutVaping.org
GET YOUR HEAD OUT OF THE CLOUD



Hate your printer? These 5 tips make printing almost lovable

In praise of the one tech product everyone loves to hate. **BY JARED NEWMAN**

I'm just going to come out and say it: Printers are the most unfairly maligned technology in modern history.

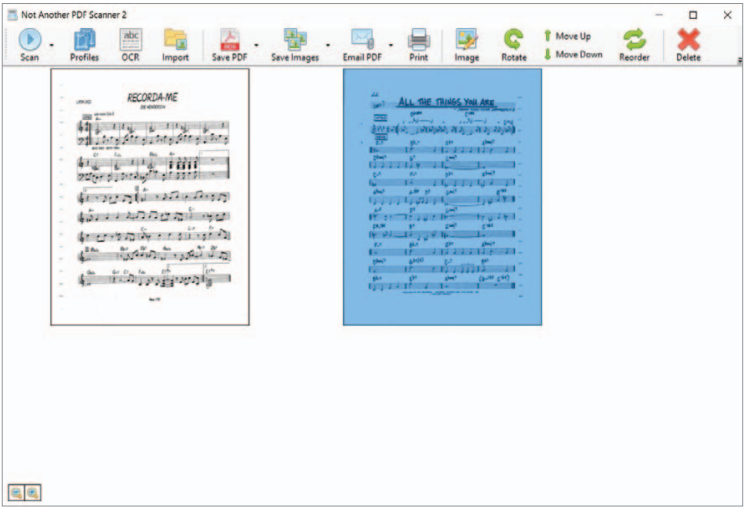
Despite all the condescension they get, printers do a lot of things right, especially compared to other tech gear. They don't scream for your attention so they can serve you targeted advertising. They're not trotted out at press events where slick executives hawk barely improved versions of what you already have. They aren't rendered obsolete by the march of annual software updates.

Instead, printers keep a low profile, only whirring and churning into action to copy a document, scan a form, or—in my case at least—spew out an ever-growing pile of Pokémon coloring pages for the kids. When this happens, the delicate dance of machinery involved (fave.co/3qwnYG8) feels like a technological marvel, especially when you realize how allergic to moving parts most electronics makers have become.

Sure, we've all had our share of paper jams and clogged nozzles, and some vendors

IMAGE: HAVE A NICE DAY PHOTO/SHUTTERSTOCK

have gotten too greedy with toner DRM (fave.co/3Nk63fC). But can you honestly say that your smartphone or computer never gives you inexplicable grief? And how often do you replace your printer anyway? Every five years? Every ten years? Try using a decade-old smartphone today and see how smoothly that goes. Replacing a problematic printer isn't even that expensive. A cracked iPhone screen alone would cost more to fix.



NAPS is a free scanner program for Windows.

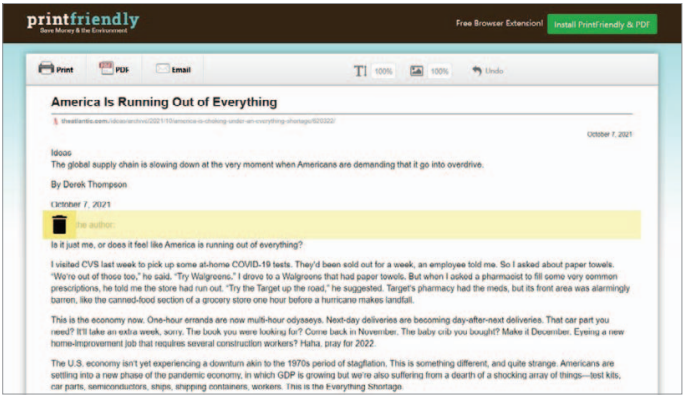
Now that I've gotten my printer rant out of the way, I shall fulfill my service journalism obligations with some tips to make your printing experience even better. Maybe they'll help you come to appreciate your own printer as well.

1. UNINSTALL MANUFACTURER BLOATWARE

Many years ago, the only way to get a printer working was to install a package of software from the manufacturer, but that bloatware probably isn't necessary anymore.

In Windows, head to Settings > Devices > Printers & Scanners, then select "Add a printer or scanner." The system should then automatically detect any Wi-Fi printers on your network and install only the bare minimum for drivers. For scanning, download Microsoft's free Windows Scan app (fave.co/356uAUc), or use the open-source NAPS2 (fave.co/3D5h3sC) if you need more options.

Want to help your Mac-loving friends and family? In MacOS, head to System Preferences > Printers & Scanners, then click the + button. Select your Wi-Fi printer from the list, and Apple will set it up automatically. You can then double-click your printer to open the print menu, where you'll also find a scan icon in the top-right corner. For faster



PrintFriendly removes clutter from webpages before printing.

Alternatively, the Printliminator bookmarklet lets you remove page elements for printing without having to copy and paste first. Just drag the Printliminator from this page (fave.co/3JCroyR) to your browser's bookmarks bar, and you can activate it with one click.

access to this menu in the future, just drag the printer icon to your dock.

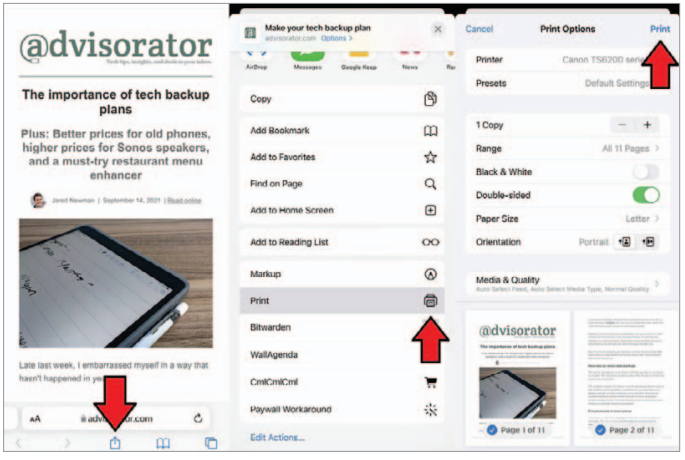
2. OPTIMIZE PAGES FOR PRINTING

You don't have to waste paper on poorly optimized webpages anymore. When you want to print a page, just copy and paste the URL into a free website called PrintFriendly (fave.co/3IzDcQP), and it'll generate a plain text version without any sidebars, links, or other clutter. You can also resize the text, click on images or unwanted text blocks to delete them, and send the results to your print menu with one click.

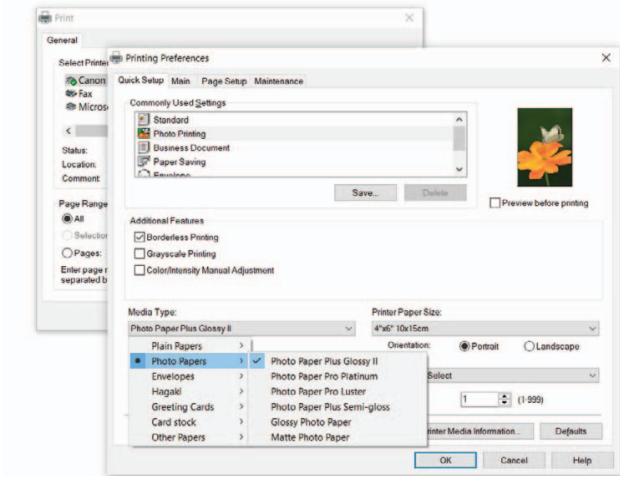
3. PRINT FROM YOUR PHONE

While it's not a feature that would headline an Apple or Google keynote, print support has quietly worked its way into iOS and Android.

While viewing a webpage, click the Share button and look for the print icon.



Printing a webpage in iOS.



Selecting a media type in Windows.

You'll also find print functions inside the menus of certain apps, such as Microsoft Word and Google Docs. Your phone should then automatically find any printer on the same Wi-Fi network, letting you print wirelessly. (The options on iOS are especially robust, even letting you choose the print quality and paper type.)

4. DON'T NEGLECT PAPER SETTINGS

When printing photos, you'll get much better results when the printer knows you're using photo paper. Unfortunately, the location of this setting can depend on which app you're using.

In Windows, you can always find this setting by selecting "print using system dialog" from the print menu, clicking Preferences, then using the Media Type dropdown menu. On a Mac, you'll usually have to choose Show Details in the print menu, then click on the dropdown that shows the name of the app you're currently using. You should see a Media Type option there.

5. PRINT NOW TO PREVENT PROBLEMS LATER

If you have an inkjet printer, long periods of neglect can lead to more clogging as the nozzles dry out, so print a color picture every couple weeks or so to reduce the risk of problems when you actually do need to put your printer to work. (The aforementioned volume of Pokémon coloring pages my kids are demanding may explain why my Canon inkjet seems to be in top shape.)

Printing a picture every couple of weeks will reduce the risk of problems when you do need to use your printer.

How to use Google Docs or Google Sheets offline

A lack of internet doesn't have to kill your productivity. **BY ALAINA YEE**

Cloud-based productivity apps are incredibly handy. They sync your info across all devices and, more important, they auto-save every change. (If you've never known the dark days of losing work because you forgot to click Ctrl+S periodically, count your lucky stars.)

The nifty part about Google Docs, Google Sheets, and even Google Slides is that you can edit your files offline. When you're not connected to the internet (or you're on a limited or bad connection), you can continue what you're doing. When you reconnect later, the changes will sync.

Turning on the feature is quick, which is handy since you have to enable it per device. Once you do, you can then toggle it per document with a single click. Here's how.

ON A DESKTOP OR LAPTOP COMPUTER (WINDOWS, LINUX, MACOS)

For offline mode in Google Docs or Google Sheets to work, you must use Chrome or Edge in standard mode. The option doesn't appear in Firefox or Opera—even though the latter is a Chromium-based browser. It also won't work in incognito mode.

IMAGE: G-STOCK STUDIO/SHUTTERSTOCK

You can activate this feature in one of the following two ways:

1. Go to docs.google.com or sheets.google.com, and then click on the hamburger menu icon in the upper left of the screen. In the Offline section, click the toggle.

2. In a Google Docs or Sheets file, go to File > Make available offline.

For both methods to work, you must be connected to the internet. If you need the Google Docs Offline extension, you'll be prompted to install it. Once that's complete, you'll be able to turn on offline mode.

After the feature is active, you'll enable it per document. Either navigate to Google Docs (fave.co/3tBg3cF) or Google Sheets (fave.co/3tBg3cF) and right-click on the file, or, within an open document, go to File > Make available offline. To disable offline access, use either of the same commands.

You will have to repeat these steps for every computer you use. That may sound like a hassle, but it's a decent security feature. All of your offline files will be saved locally, so it ensures that only the docs you select get pulled down from the cloud. You don't have to worry about leaving copies of sensitive documents on every computer you use.

ON ANDROID OR iOS

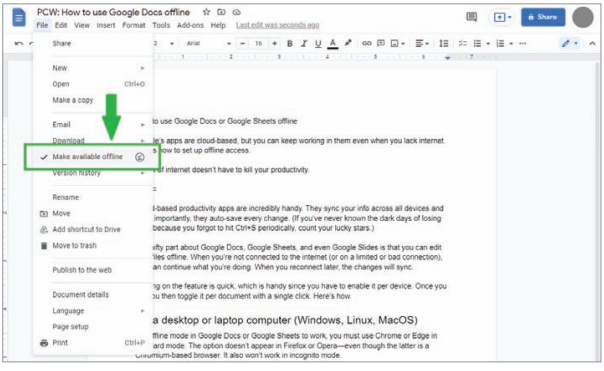
In the Google Docs, Sheets, or Slides app, you can choose to make all of your recent files available offline, make specific files available offline, or both.

For recent files, tap on the hamburger menu icon in the upper left of the app, then choose Settings. If the toggle is blue, the setting is already on. Otherwise, tap to activate it.

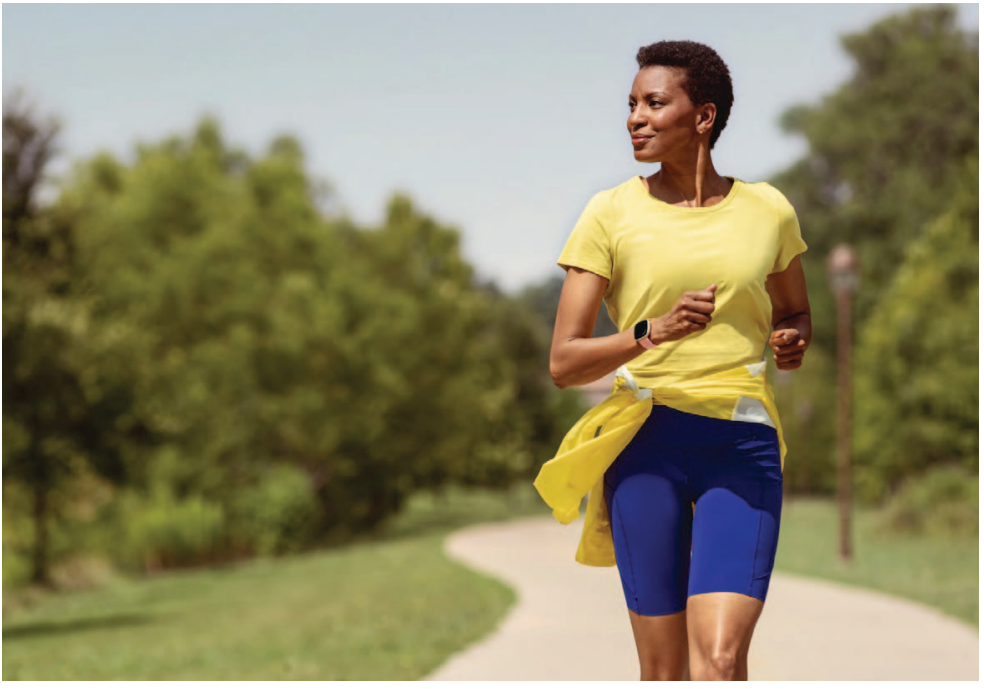
For specific files, you can tap each file's three-dot icon either in the app's main screen (found next to the file name), or at the top right of the screen when the file is open. Tap "Available online" to activate the feature. You'll either see a green checkmark or a blue toggle when it's enabled.

You can see all of the files available offline by tapping on the hamburger menu icon in the app's main screen, then choosing Offline.

To disable offline access, repeat the above commands. The green checkmark will disappear or the toggle will turn gray when offline access is turned off.



This screenshot shows the second method of activating offline mode, as outlined above.



Forgot your Fitbit tracker? Here's how to make your steps still count

It's a shame that Fitbit penalizes forgetfulness. **BY ALAINA YEE**

New Fitbit owners often expect that manual tracking of a walk or run will count toward their daily steps. Unfortunately, the Fitbit dashboard doesn't work that way. It'll let you track the exercise, but it won't count the activity toward your daily step count. Upon realizing this fact, most people assume they're out of luck whenever they forget to wear their Fitbit. That's not the case—you can get around this problem with Fitbit's MobileTrack feature.

HOW TO TURN ON FITBIT MOBILETRACK

Fitbit MobileTrack (fave.co/3wEVBtv) treats your smartphone as a basic tracker. It pulls in the step data your phone collects and then

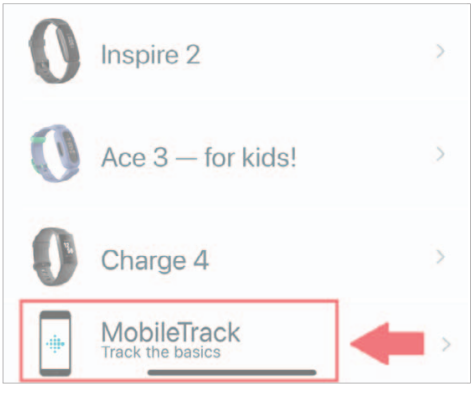
IMAGE: FITBIT

calculates the distance you've covered and calories burned.

As you'd expect, this solution works only when you turn MobileTrack on before the end of your walk or run. You can't get credit for your activity otherwise. MobileTrack is an alternative tracking method rather than a workaround for manual entries. But if you can remember to activate it, this feature performs well as a stand-in for your actual Fitbit.

To get started, go into the Fitbit app, then tap on your avatar image in the upper-left area of the screen. Select "Set up a device" and choose MobileTrack at the bottom of the screen. Apple iPhone users must also enable permission for the Fitbit app to access your Motion & Fitness data.

After you set up MobileTrack, your phone will record your steps as you walk—and those steps will count toward your daily and seven-day totals as well as any challenges you're participating in. Fitbit says where you wear the phone shouldn't impact the accuracy of the step count.



You'll find MobileTrack at the bottom of the "Set up a device" screen.

The thing to worry about is getting your MobileTrack data to stick. Fitbit does not sync that number back to your tracker—instead, whatever's on your tracker will take precedence over your MobileTrack activity. For example: You walked 15,000 steps with MobileTrack, but your Charge 5 only shows 2,500 steps. If you sync your Charge 5 and your phone after that walk, it'll overwrite the 15,000 steps with 2,500 steps.

Thankfully, you can avoid this quirk easily. Once you begin using MobileTrack, you just have to continue relying on it for the remainder of the day. Keep an eye on your phone's battery life as you do—MobileTrack can drain it faster.

If all this sounds like too much trouble—though truly, it's very simple to activate—you may want to consider a different style of wristband or a more current Fitbit (if you bought an older model). Bands made from fabric (fave.co/37R8eXL) and leather (fave.co/3NhUQMH), as well as silicon bands with air holes (fave.co/37ZsJII), can help avoid skin irritation, and the newest trackers have superb battery life, as our guide on the best Fitbits explains (fave.co/37YuU8I). These strategies will keep your tracker on your wrist for longer stretches, reducing the risk of leaving it behind when you go out.

How to securely store photos and video on Android

Keep it secret, keep it safe. **BY ALAINA YEE**

Keeping sensitive images or video on your Android smartphone? You should consider protecting them from prying eyes, whether your collection is comprised of makeshift scans of tax documentation, vaccination records, or personal videos.

A secured folder requires additional verification—typically a PIN or biometric data like a fingerprint—to gain access. On Samsung phones, this feature is known as Secure Folder. On Pixels and select other Android phones, you can use Google Photos' Locked Folder for the same purpose.

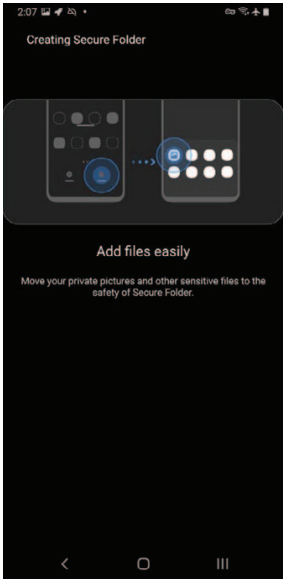
Getting set up takes only a few minutes.

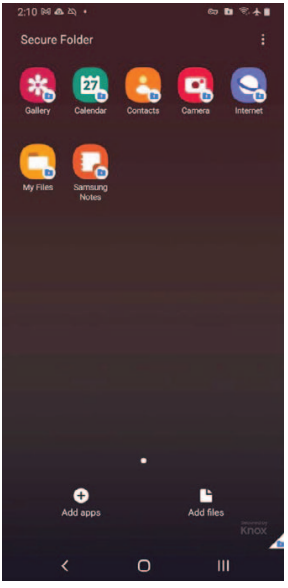
HOW TO SET UP SAMSUNG'S SECURE FOLDER

Secure Folder is available on higher-end Samsung phones dating back to the S6—you'll know your phone doesn't support the feature if you don't see the option in Settings.

IMAGE: SAMSUNG

After this screen appears, you'll see one asking you to pick a method to lock access to the Secure Folder.





The view within the Secure Folder. It functions a bit like a separate phone within your phone.

To activate this feature, open the Settings app, then select Biometrics and security. Then tap on Secure Folder.

After you agree to the terms and log in with a Samsung or Google account, a Creating Secure Folder screen will appear. A second screen will follow, asking you to choose a lock type for the folder. A password is most secure, followed by a PIN, then a pattern. You can also enable biometric unlocks.

You can now use the Secure Folder to not only move over sensitive photos and videos, but other file types as well. You can also add files directly to the Secure Folder, as well as install apps—the latter is handy if you, say, want to keep others from knowing where you bank. You're essentially in a separate sandbox that keeps its data stored apart from the rest of the device.

By default, anything in the Secure Folder isn't backed up to the cloud—you have to set that up yourself. While in the Secure Folder, go to Settings > Backup and restore. You'll need a Samsung account to set up backups (both automatic and manual).

HOW TO SET UP THE LOCKED FOLDER IN GOOGLE PHOTOS

Google's primary advantage over Samsung is that its Locked Folder is available to non-Samsung phones, with device support continuing to widen. However, Google

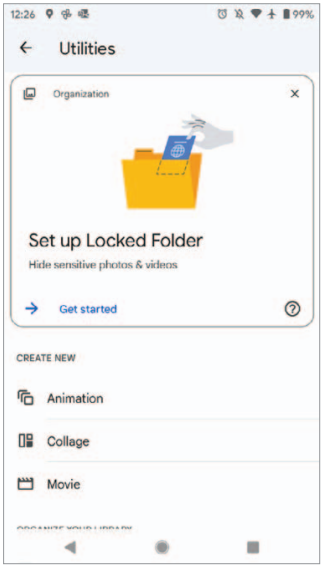
Photos supports only photos and video, and anything in your Locked Folder also is stored only on your phone. (For other file types, you'll need to use the Safe Folder in Google Files.)

That means if you have automatic backups enabled in Google Photos, any files in your Locked Folder won't sync to the cloud. You will lose these photos if you wipe your phone, uninstall the Google Photos app, or clear the app's data. You must upload them manually to a service while they're outside your Locked Folder. If you prefer cloud syncing with walled-off access for select files, you can try OneDrive and its Personal Vault feature instead.

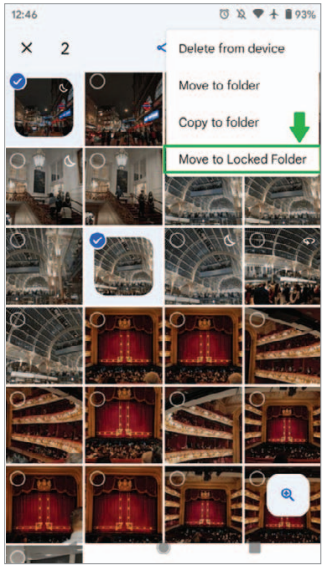
To set up the Locked Folder, open the Google Photos app. Tap on Library at the bottom of the screen, then on Utilities in the upper-right corner. Find Locked Folder, then tap on it to begin the setup process.

After your Locked Folder is ready, you can transfer over your photos and videos by long-pressing and selecting files, tapping the three-dot icon at the top right of the screen, and choosing Move to Locked Folder.

Pixel smartphones (Pixel 3 and newer) can also take photos or record videos directly to the Locked Folder. In the Camera app, tap the folder icon in the upper right of the screen, then choose Locked Folder. Anything you capture will save directly to that folder, reducing the number of steps needed to ensure your privacy.



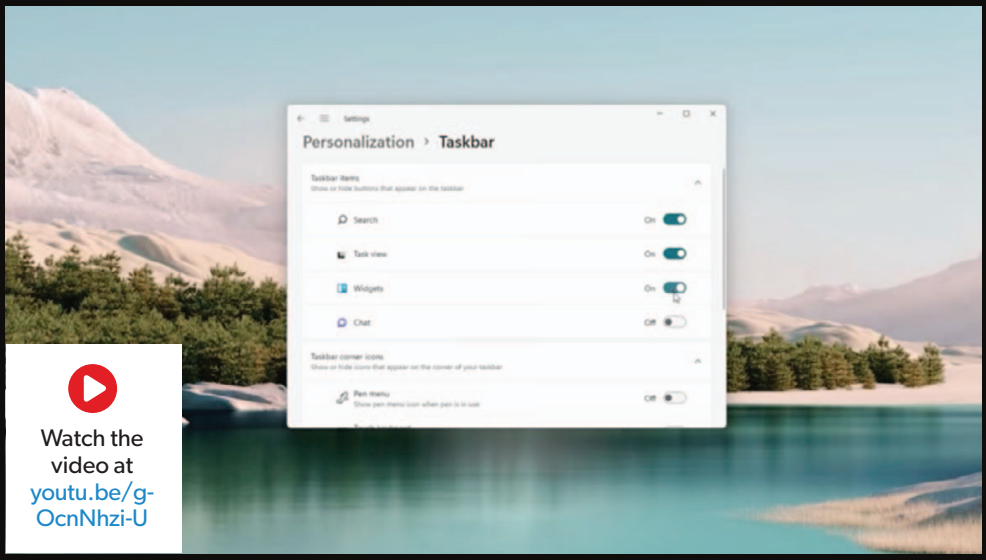
You may see this invitation to set up the Locked Folder at the top of your Utilities menu. You can click on Get Started to begin. Otherwise follow the directions given in this article.



You can quickly add multiple photos or videos to the Locked Folder from Google Photo's main screen.

Tech Spotlight

A video showcase of the latest trends



Watch the video at youtu.be/g-OcnNhzi-U

Windows 11 Spring 2022 "Update": Top New Features & Changes

Windows 11's first big update has arrived, and Mark is here to show you the top new features and changes you'll find present in this new experience.