Tech Spotlight

A video showcase of the latest trends

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What Type of SSD Should You Buy?

Confused about the different types of SSDs? Not sure which one you should put in your PC? Alaina Yee breaks down the speeds and feeds as well as the form factors that you need to know about when making your decision.

FIRST LOOK: INTEL LAUNCHES TIGER LAKE H

PCWorld

JUNE 2021

FROM IDG

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IF YOU HAVE A DELL PC, FIX THIS SECURITY FLAW NOW

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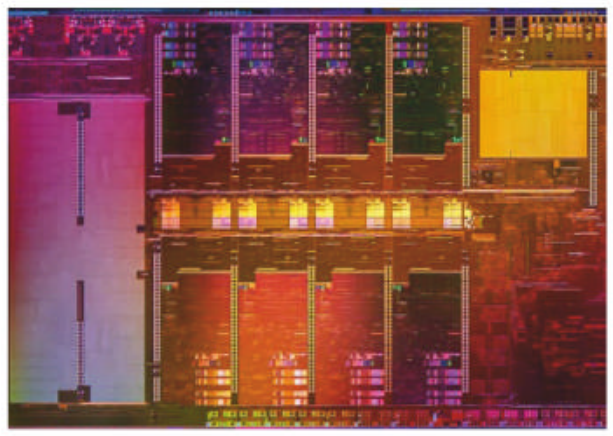

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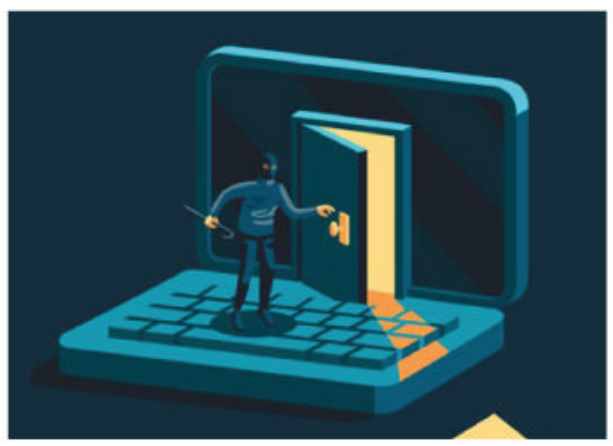

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PUBLICATION INFORMATION

Volume 39, number 6 *PCWorld*™ (ISSN 0737-8939) is published monthly at $24.95 for one year (12 issues) by IDG Communications, Inc. Published in the United States.

AMERICA'S DEADLIEST SHOOTINGS ARE ONES WE DON'T TALK ABOUT

On any given day in America, an average of 63 of our mothers, brothers, partners, and friends are taken from us by gun suicide. But tomorrow's deaths could be prevented. Give your loved ones a second chance at life. Store your guns safely: locked, unloaded, and away from ammo.

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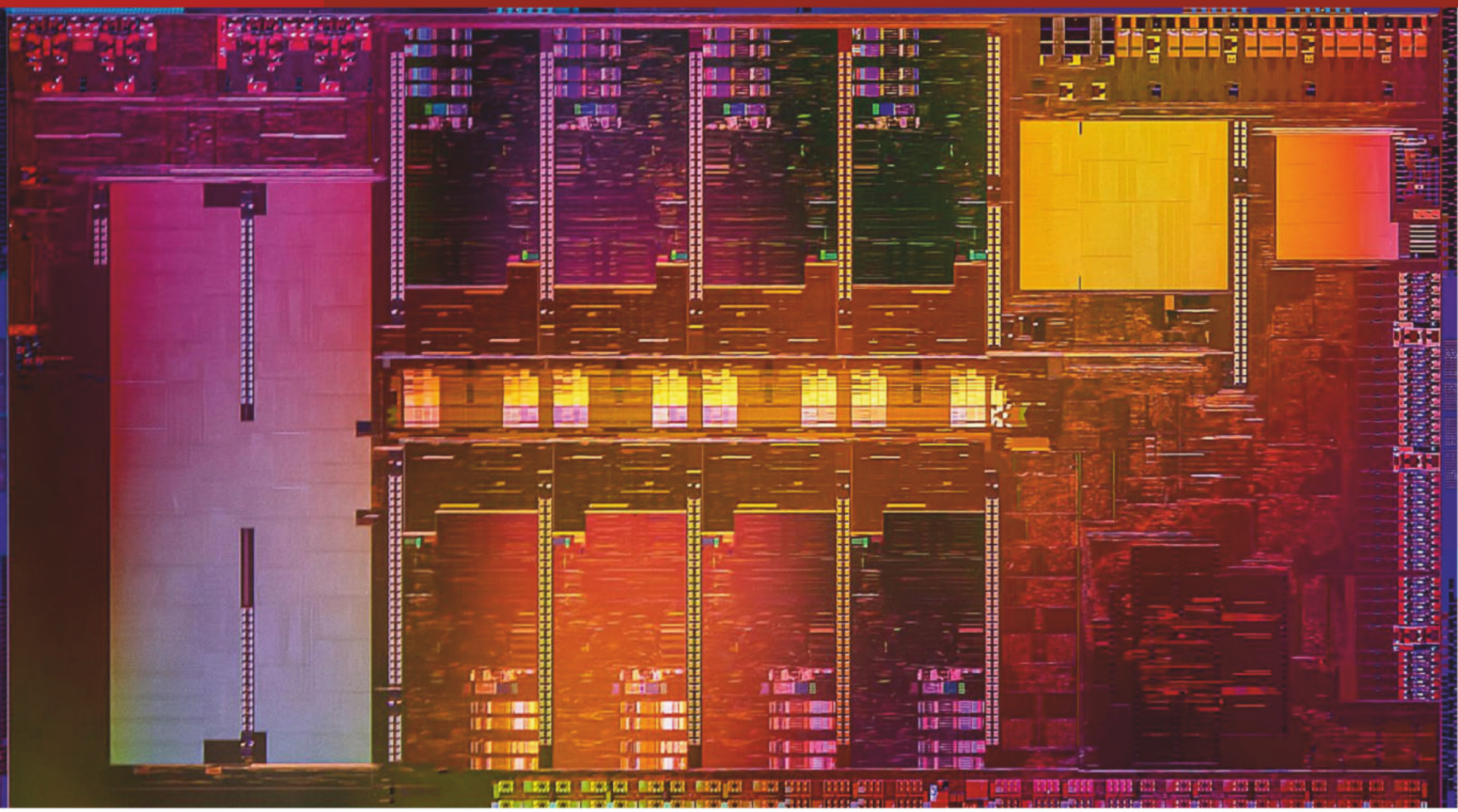


Intel launches 11th-gen Tiger Lake-H CPUs for gaming notebooks

Intel's latest processors for gaming PCs trim clock speeds a bit, but offer what Intel says are substantial performance improvements and lower power use. **BY MARK HACHMAN**

Just a few short months after Intel launched the 11th-gen Core H35-series microprocessors for mobile gaming, Intel is at it again: On Tuesday, Intel officially launched the 11th-gen Core Tiger Lake H-series processors for mainstream and gaming laptops.

The product line includes five new processors, including the premium unlocked Core i9-11980HK, the Core i7-11800H, and a pair of Core i5 processors. Quad-core processors have disappeared from the lineup. Instead, the new chips include hyperthreaded six-core and eight-core processors, offering double the cores of the 11th-gen Tiger Lake cores Intel launched in September (go.pcworld.com/11gn).

Versus last year's 10th-gen Core mobile gaming chips (go.pcworld.com/cmtl), base core clock frequencies are slightly up across the board. The maximum single-core boost clock has dipped, though—possibly a black

IMAGE: INTEL

mark for gamers. However, Intel is once again publishing its all-core turbo speeds, and they're substantial. Supported memory speeds have climbed from DDR4-2933 to DDR4-3200. Power has dropped, too: Virtually all of the new processors are rated at 35W rather than 45W. Overall, Intel claims that the Tiger Lake-H platform offers three times the platform bandwidth of its predecessor, with a mix of 20 PCI Express 4.0 and 24 PCI Express 3.0 lanes. Oh, and integrated graphics have returned, too.

Intel would also like to tacitly remind you that demand for rival AMD's Ryzen processors is outstripping supply. Intel executives say they'll ship more than a million of the 11th-gen Core H processors to customers by launch as part of more than 80 new designs. They'll also continue selling 10th-gen H-series chips. Naturally, Intel believes its new 11th-gen Core H parts outperform AMD's Ryzen 9 5000 processors in gaming, by about 11 to 22 percent.

INSIDE A TIGER LAKE-H GAMING NOTEBOOK

It's been a busy year or so for Intel. Let's recap: Last April, Intel launched the 10th-gen Intel Comet Lake-H processors (go.pcworld.com/cmtl). The Core i7-10875H finally reached 8 cores and 16 threads, while the premium Core i9-10980HK topped out at 5.3GHz. Our tests of the Core i7-10875H (go.pcworld.com/187h) proved it was indeed the fastest Core i7 processor to date, though our tests of AMD's Ryzen 4000 Mobile (go.pcworld.com/4mob) processor showed Ryzen keeping pace. In January, Intel added new 10th-gen Core i5 and Core i7 Comet Lake-H chips to the lineup.

January's launch, not this recent one, was Intel's first 11th-gen mobile Core debut (go.pcworld.com/mh35), when it pioneered a new ultraportable gaming segment with the Core H35 series. It was then that PCI Express 4.0, Wi-Fi 6E and Intel's Killer networking technology arrived in Intel's 11th-gen

Here's how Intel sees the gaming notebook market breaking down.

11th Gen Intel® Core™ Consumer Mobile Processors

Processor Number	Cores / Threads L3 Cache	DDR4 (MT/s)[1]	Base Freq (GHz) @45W TDP	Intel® Turbo Boost Technology					Freq (GHz) @config TDP	Graphics Branding	Graphics Base / Max (MHz)	Tj (deg C)	Intel® Technologies		
				Max 1-Core Turbo (GHz)	Max 2-Core Turbo (GHz)	Max 4-Core Turbo (GHz)	Max 6-Core Turbo (GHz)	Max 8-Core Turbo (GHz)					Intel® SIPP	Intel® vPro™	Intel® TXT
i9-11980HK	8C/16T 24M	3200	2.6	5.0 *w/ ITBM3.0*	5.0 *w/ ITBM3.0*	4.9	4.7	4.5	3.3 @ 65W	Intel® UHD Graphics	350 / 1450	100	No	No	No
i9-11900H	8C/16T 24M	3200	2.5	4.9 *w/ ITBM3.0*	4.9 *w/ ITBM3.0*	4.8	4.6	4.4	2.1 @ 35W	Intel® UHD Graphics	350 / 1450	100	No	No	No
i7-11800H	8C/16T 24M	3200	2.3	4.6	4.6	4.5	4.4	4.2	1.9 @ 35W	Intel® UHD Graphics	350 / 1450	100	No	No	No
i5-11400H	6C/12T 12M	3200	2.7	4.5	4.5	4.3	4.1	N/A	2.2 @ 35W	Intel® UHD Graphics	350 / 1450	100	No	No	No
i5-11260H	6C/12T 12M	3200	2.6	4.4	4.4	4.2	4.0	N/A	2.1 @ 35W	Intel® UHD Graphics	350 / 1400	100	No	No	No

Intel is offering five new 11th-gen Core H–series chips for consumers.

mobile processors. Now they've migrated to the mainstream gaming line as well.

What does an 11th-gen Core mainstream gaming notebook include? According to Kim Algstam, interim general manager of Intel's Innovation and Enthusiast team and director of Intel's enthusiast laptop innovation team, Intel's aiming its Core i5 H-series chips at "essential" gaming notebooks for as little as $699 to $999, running at 1080p resolutions at Medium to High settings. More expensive models will be priced between $999 to $1,999: 15- to 17-inch notebooks running at either 1080p/240Hz or 4K/60 resolutions, and more powerful "halo enthusiast" notebooks running at 4K/120 resolutions at maxed-out settings. (Up to 1080p/360 and 4K/120 displays are supported, too.) All will include discrete, enthusiast-class GPUs from either Nvidia or AMD.

Interestingly, Algstam said Intel is helping support a new display size of 16 inches, which would split the difference between the more traditional 15-inch and 17-inch gaming laptops. Intel also sees 1440p resolutions as the "new gaming standard."

HERE ARE INTEL'S 11TH-GEN CORE MOBILE PROCESSORS

The architecture of the chips themselves doesn't hide any surprises. These are 10nm chips, designed around the Willow Cove CPU cores Intel talked up last year (go.pcworld.com/wlcv). However, Intel executives said that though the GPU cores are designed around the Xe architecture, they're being branded as Intel UHD Graphics for some reason. That's still a change from the 10th-gen Comet Lake-H chips (go.pcworld.com/cmtl), when Intel said gamers simply preferred

discrete graphics and didn't need an integrated GPU.

Intel's chart, previous page, includes several different scenarios. The base clock speed of the Core i9-11980HK, for example, is just 2.6GHz. Intel is also showing that chips like the Core i9-11900H, while designed for 35W, will typically run inside a 45W notebook and at a slightly faster speed when doing so.

At 45 watts, these 35W chips will run a bit faster. When boosted using the Intel Turbo Boost Max 3.0 technology, either one or two "favored" cores can reach 5.0GHz for a short time. Scenarios like our Cinebench benchmark will push *all* of the cores on that chip to 4.5GHz, consequently pushing up the power consumption to as high as 135 watts, according to Ryan Shrout, Intel's performance guru.

The "K" suffix designates an unlocked part that can be overclocked. Intel executives also alluded to "partially overclockable" chips that can use Intel's Speed Optimizer, but didn't clarify which ones they were.

Intel also launched several similar processors for the commercial segment, featuring vPro technology.

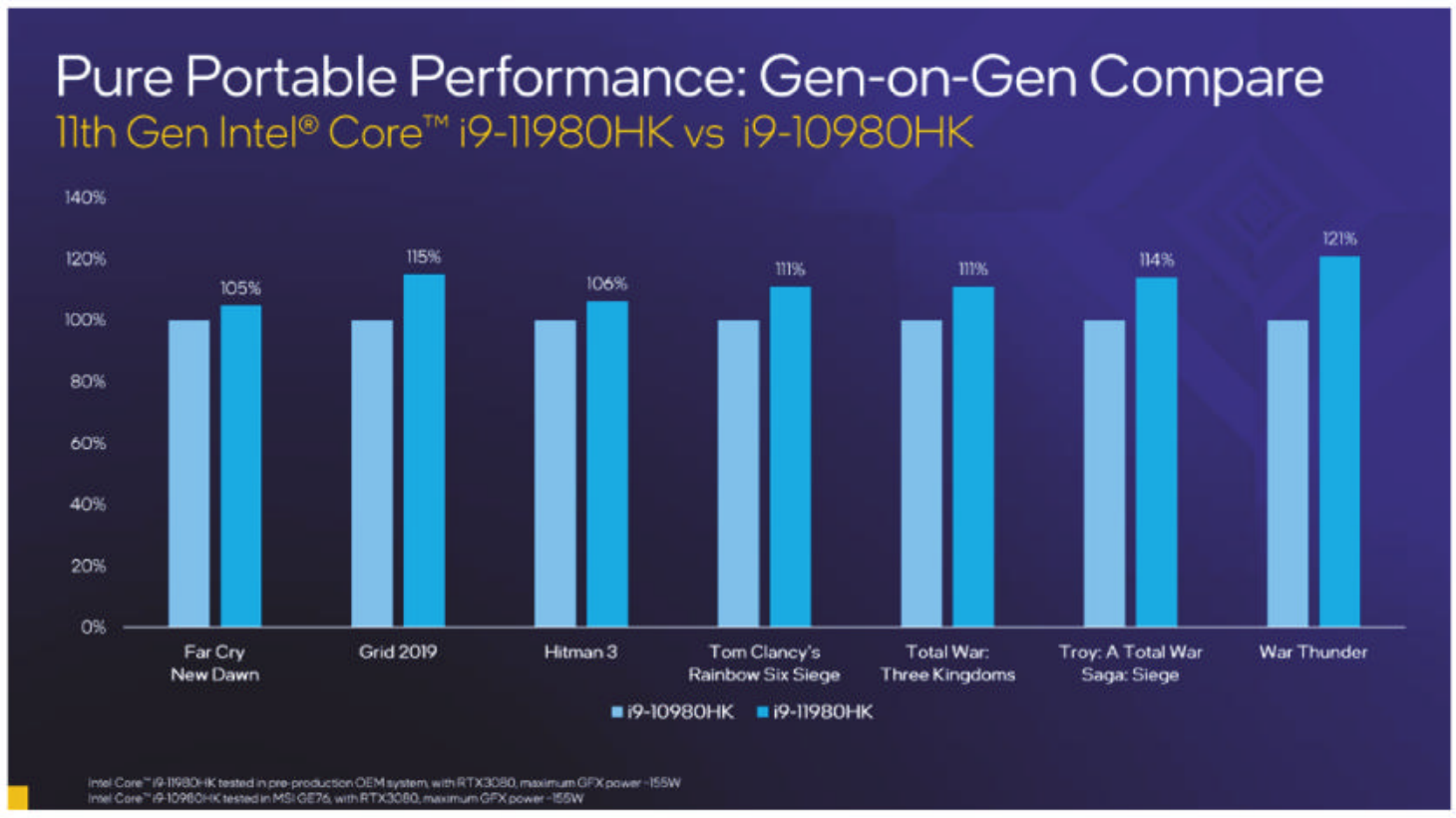
INTEL'S PERFORMANCE BENCHMARKS FOR ITS 11TH-GEN CORE-H MOBILE PROCESSORS

How fast is the new 11th-gen Tiger Lake H processor? Intel claims there's a 19 percent generation-to-generation performance increase (as measured by the SPEC_int_rate_base2017 benchmark) between the Core i9-11980HK processor and the earlier Core i9-10980HKchip. In gaming, Intel says that you'll see frame rate improvements between 5 and 21 percent in some popular titles.

Intel ran similar benchmarks comparing

11th Gen Intel® Core™ Commercial Mobile Processors

Processor Number	Cores / Threads L3 Cache	DDR4 (MT/s)[1]	Base Freq (GHz) @45W TDP	Intel® Turbo Boost Technology					Freq (GHz) @config TDP	Graphics Branding	Graphics Base / Max (MHz)	Tj (deg C)	Intel® Technologies		
				Max 1-Core Turbo (GHz)	Max 2-Core Turbo (GHz)	Max 4-Core Turbo (GHz)	Max 6-Core Turbo (GHz)	Max 8-Core Turbo (GHz)					Intel® SIPP	Intel® vPro™	Intel® TXT
W-11955M	8C/16T 24M	3200	2.6	5.0 w/ITBM3.0	5.0 w/ITBM3.0	4.9	4.7	4.5	2.1@35W	Intel® UHD Graphics	350/1450	100	Yes	Yes	Yes
i9-11950H	8C/16T 24M	3200	2.6	5.0 w/ITBM3.0	5.0 w/ITBM3.0	4.9	4.7	4.5	2.1@35W	Intel® UHD Graphics	350/1450	100	Yes	Yes	Yes
W-11855M	6C/12T 18M	3200	3.2	4.9 w/ITBM3.0	4.9 w/ITBM3.0	4.7	4.4	N/A	2.6@35W	Intel® UHD Graphics	350/1450	100	Yes	Yes	Yes
i7-11850H	8C/16T 24M	3200	2.5	4.8	4.8	4.8	4.6	4.3	2.1@35W	Intel® UHD Graphics	350/1450	100	Yes	Yes	Yes
i5-11500H	6C/12T 12M	3200	2.9	4.6	4.6	4.4	4.2	N/A	2.4@35W	Intel® UHD Graphics	350/1450	100	Yes	Yes	Yes



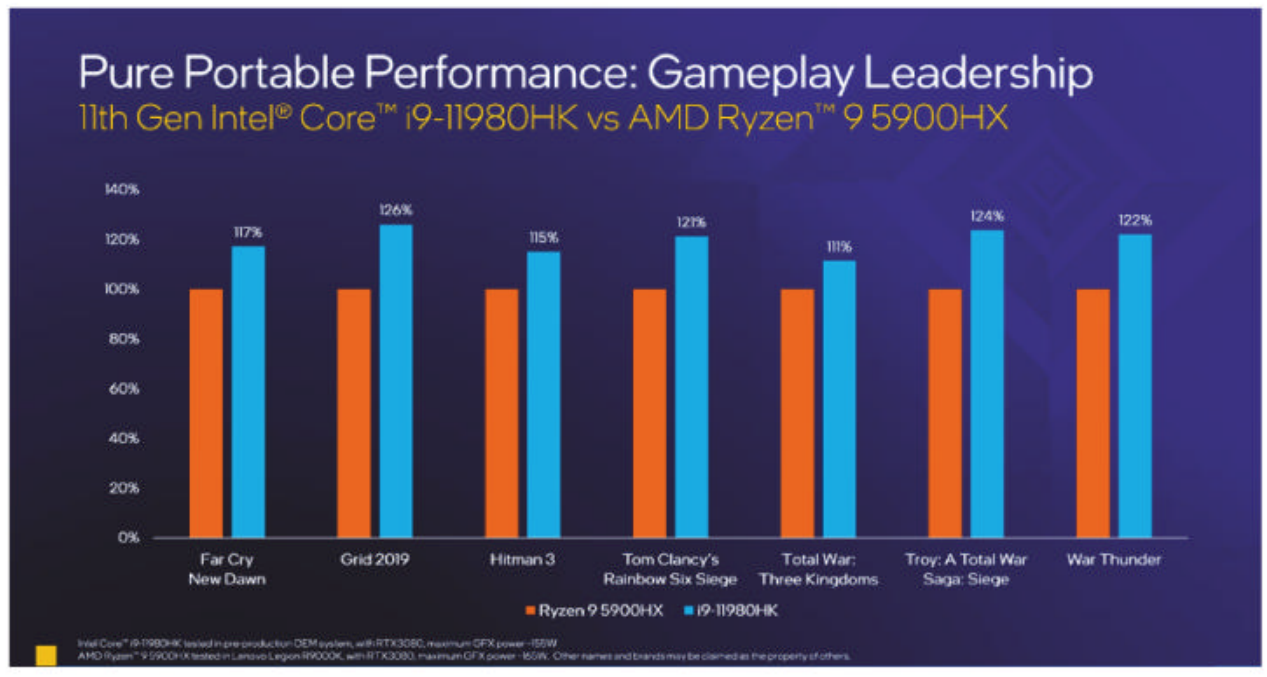
Here's what Intel claims are the generational improvements over the older 10th-gen Core-H chips. Both systems are using an Nvidia GeForce RTX3080 GPU.

the top-of-the-line Core i9-11980HK versus the Ryzen 9 5900HX, AMD's most powerful processor. Again, Intel is using gaming as the point of comparison, with an RTX 3080 supplying the graphics horsepower. In the games Intel selected, the 11980HK outperforms the 5900X by up to 26 percent.

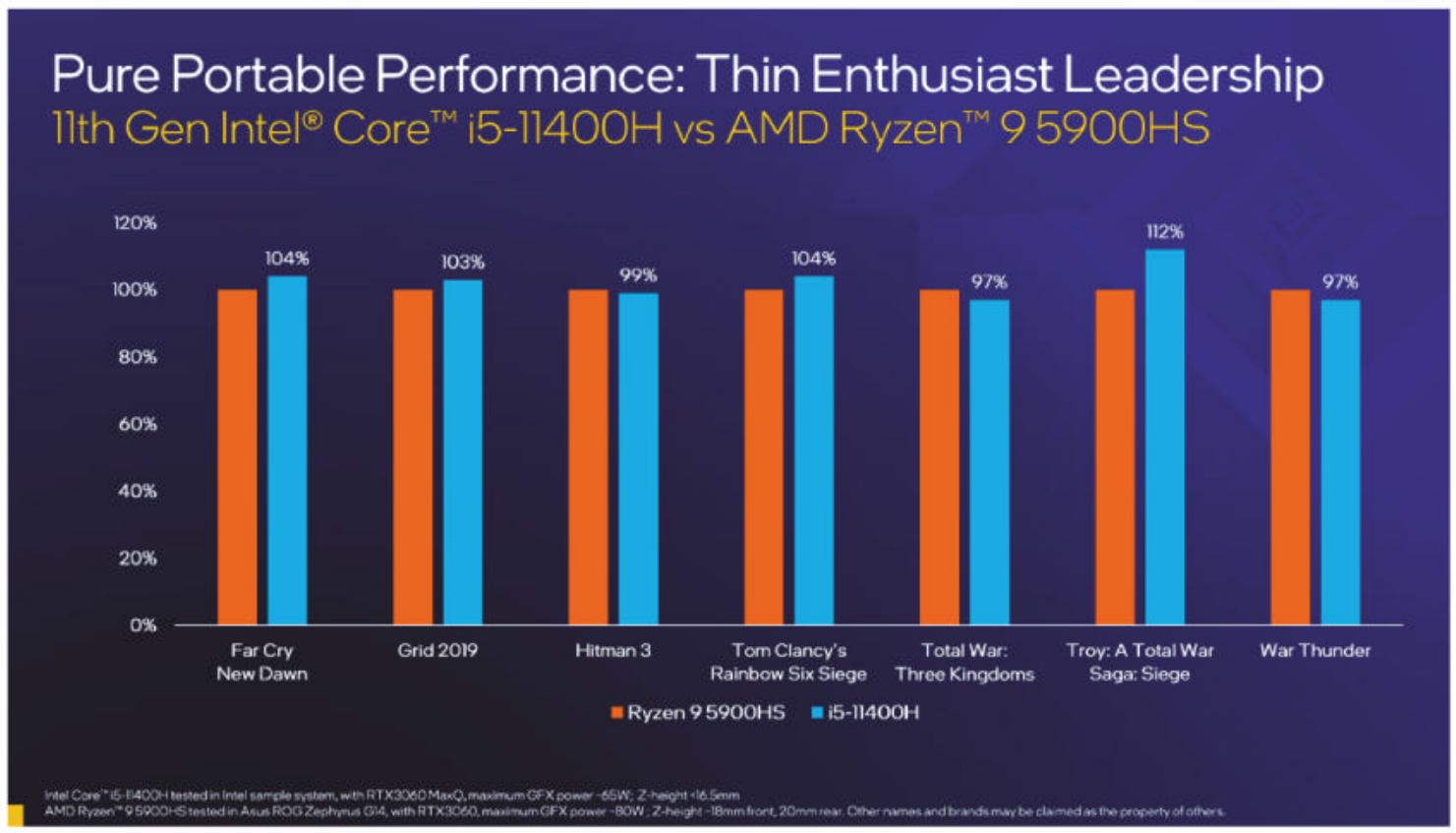
Intel used a similar subset of games to draw a comparison between the much more affordable Core i5-11400H and the Ryzen 9 5900HS. Here, the two processors are more closely matched, with Intel admitting that its rival outperforms it in certain situations. Intel, however, claims that its demo notebook is just 16.5mm thick and consumes 65W, while the Ryzen system measures as much as 20mm thick and consumes up to 80 watts.

In content creation, Intel is claiming a 22 percent generation-over-generation improvement in Photoshop, and 20 percent in video creation. Intel believes it holds 24 percent and 18 percent advantages in those two, respectively, over Ryzen 9 5900X. Intel's Shrout said he believes those improvements stem from the overall computational gains from one generation to the other, plus some of the AI-specific enhancements like DLBoost that Intel has built in.

How does Intel's 11th-gen Core match up



Intel is claiming that its top-of-the-line Core i9-11980HX handily outperforms AMD's Ryzen.



Many gamers will buy a Core i5 system simply because it offers a lower price without trading off much in the way of performance. Here, Intel's Core i5-11400H is compared to the Ryzen 9 5900HS. Remember, these are Intel's benchmarks.

to Apple's M1? "We don't have any of that information here to share today," Shrout said.

THE IMPROVEMENTS TIGER LAKE-H ADDS TO MOBILE PCS

As AMD's Ryzen has risen to challenge Intel's Core chips directly, Intel has shifted gears to emphasize some of the other advantages an Intel PC brings beyond raw performance. These platform improvements touch on other aspects of the PC that may be unique to Intel, generally emphasizing additional bandwidth such as the new 40Gbps Thunderbolt 4 specification (go.pcworld.com/40gs) for connecting external storage. For better or worse, Thunderbolt is still largely exclusive to Intel PCs, with exceptions like this Asus desktop motherboard (go.pcworld.com/asmb). Intel isn't even mentioning USB4, though the USB4 specification and Thunderbolt 4 go hand in hand (go.pcworld.com/u4t4).

For Intel's new Tiger Lake-H laptops, a few capabilities stand out. For one, the platform now supports DDR4 3200, which represents a small 9 percent boost from the DDR4 2933 memory speeds of the 10th-gen parts.

These days, the PCI Express bus is primarily used just for discrete graphics and storage. Intel's Tiger Lake-H laptops contain 20 lanes of PCI Express 4.0 I/O directly attached to the CPU, allowing for an x16 discrete GPU plus an x4 SSD for internal PC storage.

The DMI link between the host CPU and the accompanying 500-series PCH chipset has also been widened, to an x8 interface. All this means that the available bandwidth between the I/O chip and the CPU has doubled, allowing the PCH an additional 24

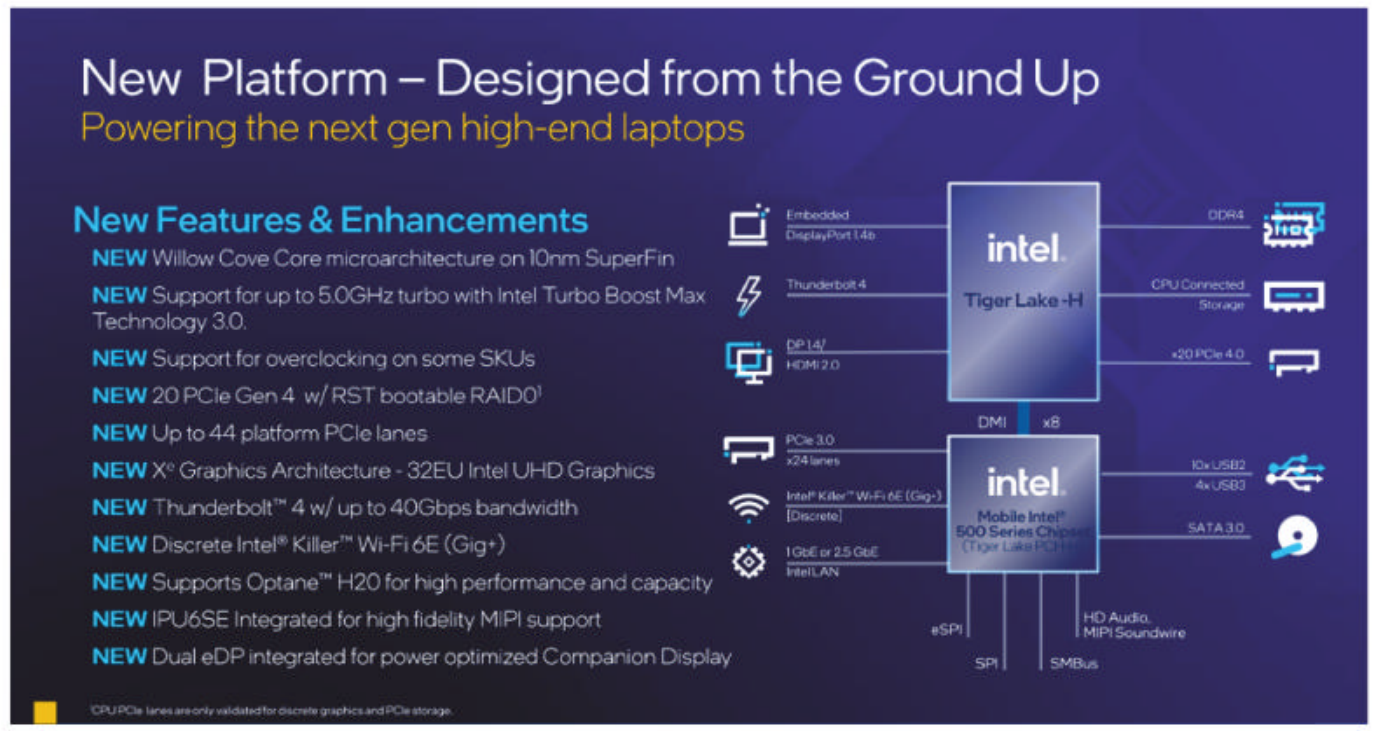
lanes of PCI Express 3.0 storage to an external GPU or additional SSDs. These are PCI Express 3.0 lanes, granted, with half the bandwidth of the PCIe 4.0 lanes directly attached to the CPU.

Still, you may see notebooks that combine SSDs attached to both PCIe 4 and PCI 3, to create RAID 0 arrays that could increase a laptop's storage performance even further. And, of course, Intel has also included support for its H20 Optane drives.

Because Intel envisions its Tiger Lake-H notebooks being used with external graphics, the platform's integrated graphics come as a little bit of a mystery. These chips include integrated graphics based on the Xe architecture, and with 32EUs to boot—but they're being marketed as Intel UHD Graphics. They do include an unexpected bonus: They've been designed to work with two external DisplayPort connections, specifically for the secondary companion displays that have begun cropping up in dual-screen laptops like the Asus ZenBook Pro Duo (go.pcworld.com/azpd). It's reasonable to expect that they'll be able to step in and power day-to-day web and Office work versus using the external GPU, helping preserve your laptop's battery life. They also support AV1 decoding (go.pcworld.com/av1d) in hardware.

Finally, these new 11th-gen Tiger Lake platforms include Intel's Killer networking technology, which Intel acquired a year ago (go.pcworld.com/wf6e) for gaming PCs. The new notebooks will include support for Wi-Fi 6E (go.pcworld.com/wf6e), which adds a new dedicated 6GHz Wi-Fi channel for (hopefully) less wireless congestion.

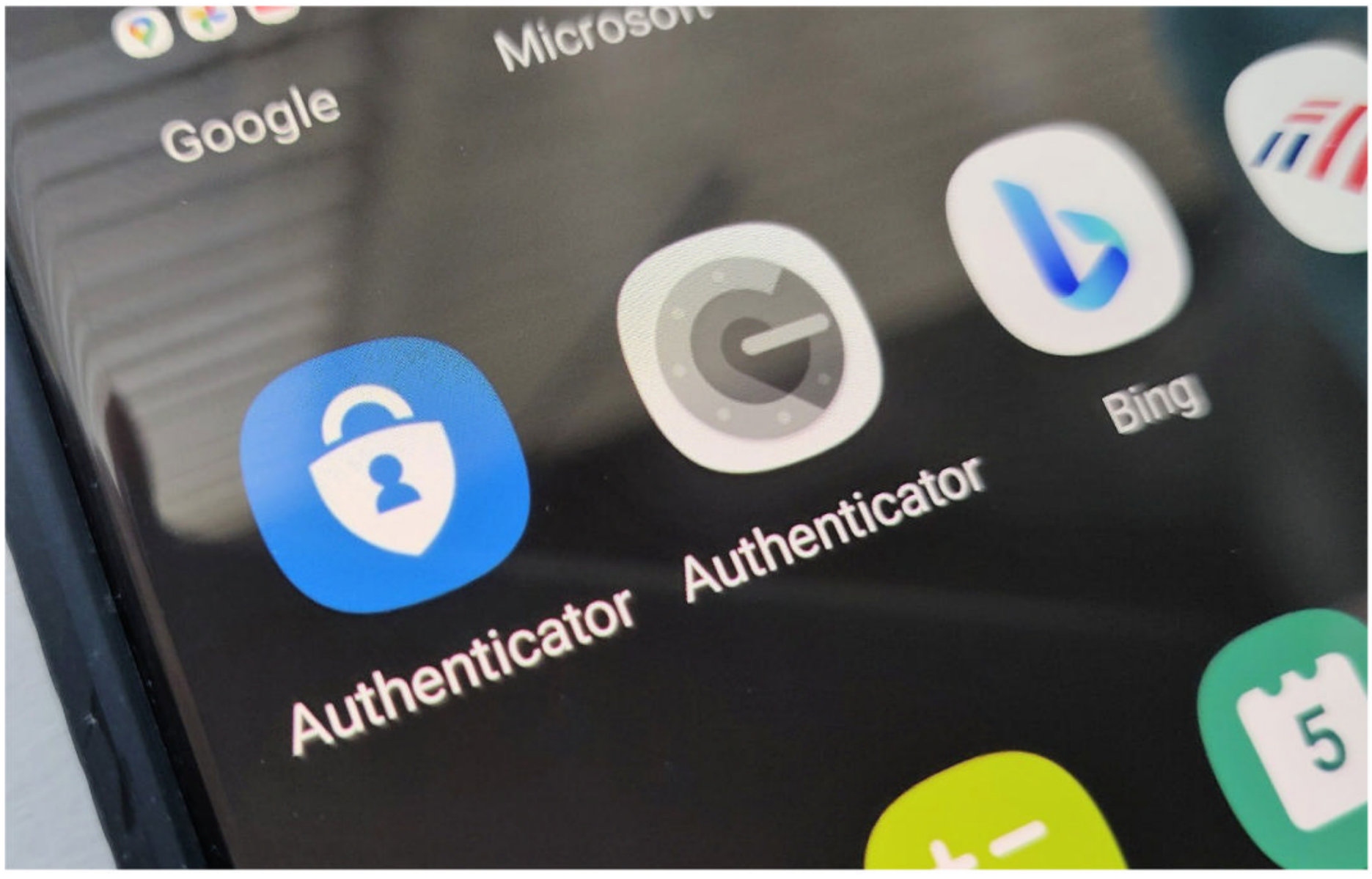
With a global semiconductor shortage, a cryptocurrency craze, and opportunistic resellers and bots snapping up the available supply of discrete desktop GPUs, gaming notebooks are not just a nice luxury—in certain cases, they may be the only way for gamers to be able to play the latest games. Intel's new 11th-gen Core H–series mobile parts may take on an outsize importance as the weeks progress.



A summary of the improvements Intel has added to its mobile 11th-gen Core platform, code-named Tiger Lake H.

Google to automatically enroll users in two-factor authentication soon

Google hates passwords, so it's trying to replace them with 2FA. **BY MARK HACHMAN**

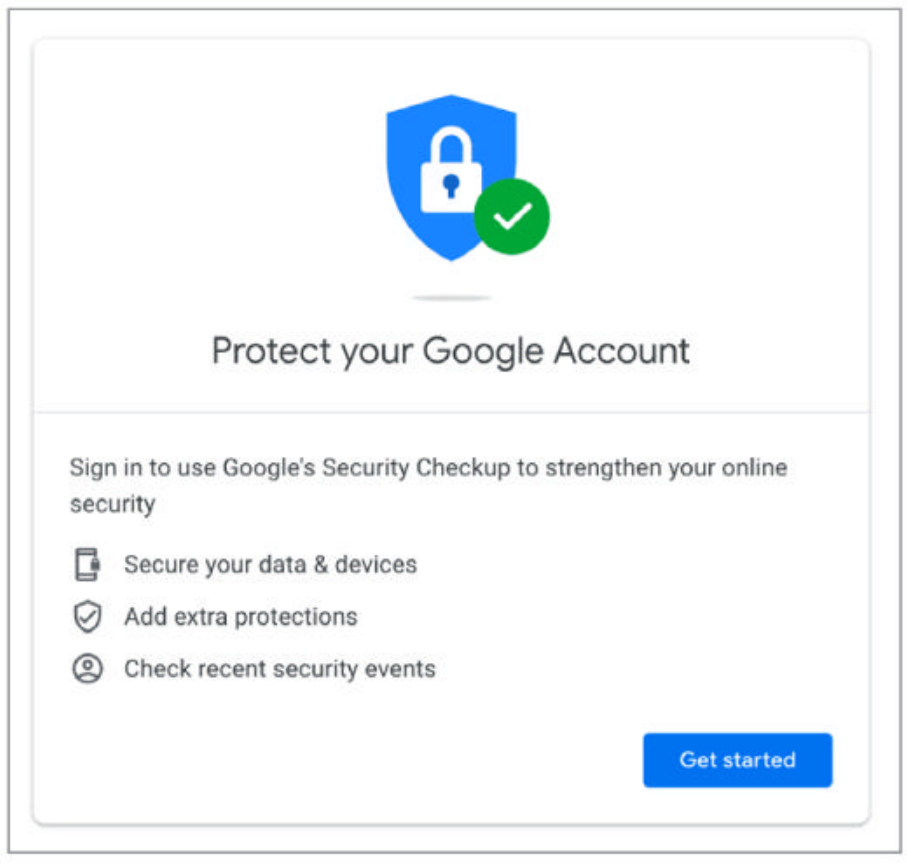


Most security experts agree that two-factor authentication (2FA) is a critical part of securing your online accounts. Google agrees, but it's taking an extra step: It's going to sign up Google account holders up for two-factor accounts automatically.

Google sees two-factor authentication as a replacement for passwords, which Mark Risher, Google's director of product management for identity and user security, in a statement called "the single biggest threat to your online security." Because they're easy to steal and hard to remember, users will end up reusing passwords. If stolen, they can be used to unlock multiple user accounts, adding to the risk.

Google already uses 2FA to secure accounts, but it's been optional until now. If you have 2FA enabled on your Google account, for example, you can view the passwords Google knows (go.pcworld.com/

IMAGE: MARK HACHMAN



You can check whether 2FA is set up on your account by going to Google's Security Checkup page (go.pcworld.com/secp).

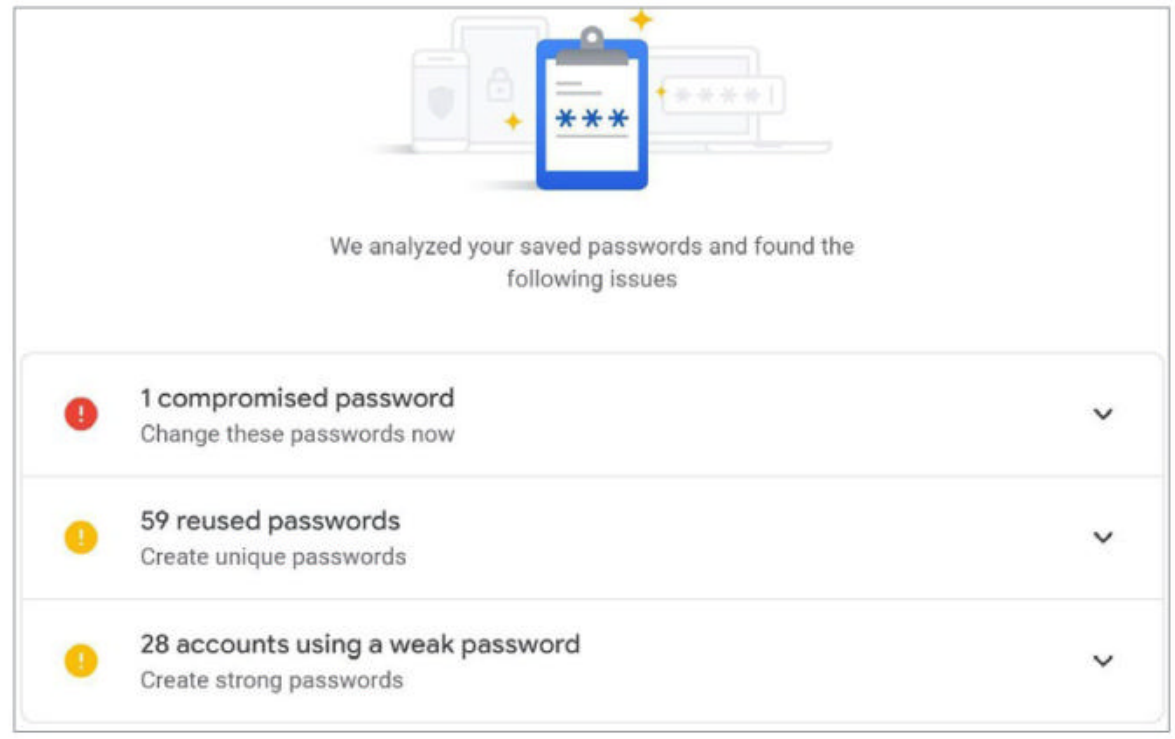
vwps) by entering your passwords, and then confirming your login on a separate phone via Google's Authenticator app. (It's no coincidence that Google announced this on the so-called World Password Day.) This is two-factor authentication: compounding your security by taking something you know (a password) and combining it with something you have (an authorized phone).

According to Risher, Google will start "automatically enrolling users in 2SV [what Google calls 2FA] if their accounts are appropriately configured." Google said that users would be given an opportunity to opt out, too.

HOW GOOGLE'S 2FA ENROLLMENT WILL WORK

What does "appropriately configured" mean? According to Jonathan Skelker, product manager for account security at Google, the term means "users that already have recovery information on their accounts, such as a phone number or [secondary] email." Google's Security Checkup page (go.pcworld.com/secp) already communicates whether 2FA is set up on your account, and will presumably be the way by which you'll know if you need to set up 2FA and how you'll do it.

Google already allows you to import your passwords stored in other browsers or in password managers into Google's own Password Manager. Google also can generate its own passwords and use them when you sign up for a new service or site via Chrome. Google's Password Checkup feature (go.pcworld.com/goup), for the web as well



An example of results from Google's Password Checkup.

as for Android (go.pcworld.com/pcan), also automatically checks your passwords against known password breaches. It's not good enough to use our tips on how to create strong passwords (go.pcworld.com/h2ps); you have to know when your passwords have been stolen (go.pcworld.com/stln) as part of a breach, and take quick action.

Late Wednesday night, Google issued a clarification saying that users would be given the ability to opt out in the case where they needed to be able to access their accounts. "More factors means stronger protection, but we need to ensure users don't get accidentally locked out of their accounts," Google said in a statement attributed to Risher. "That's why we're starting with the users for whom it'll be the least disruptive change and plan to expand from there based on results.

"The reality is passwords are no longer a sufficient form of authentication—they are painful for people and easy for hackers to access. It used to be that multifactor authentication was considered tedious and challenging to set up—that is no longer the case. Many users are already positioned to use a second step of verification across their accounts—this auto enrollment process is a way for us to help get them there. Users can opt out of this change and keep their account security settings the same."

If you hate passwords, though, take heart: Google's working to eliminate them eventually. "One day, we hope stolen passwords will be a thing of the past, because passwords will be a thing of the past," Risher said.

HaveIBeenPwned (go.pcworld.com/hbpn) supplies a large amount of information in regards to breaches.

Samsung's new Galaxy Book Pro laptops are thin, light, and smart

AMOLED displays and intelligent settings are standout features. **BY MELISSA RIOFRIO**

Samsung recently unveiled its new Galaxy Book Pro and Galaxy Book Pro 360 laptops. The four thin-and-light systems are designed with premium features, innovative enhancements, and close ties to the rest of Samsung's product ecosystem.

Announced at the company's virtual Samsung Unpacked event on April 28, the laptops started shipping May 14. Prices will start at $1,000 for the Galaxy Book Pro 13 and $1,100 for the Galaxy Book Pro 15 clamshell notebooks. The convertible models (with 360-degree hinges) start at $1,200 for the Galaxy Book Pro 360 13 and $1,300 for the Pro 360 15. Samsung is also offering special discounts through Amazon, Best Buy, and its own online store.

We'll discuss some of the highlight features of the Galaxy Book Pro laptops, and you can find the specs for all the machines at the end of this story. The photos will show you

IMAGE: SAMSUNG

The Samsung Galaxy Book Pro 13 (shown here in Mystic Silver) is so thin and light, you'll forget it's in your bag.

the colors available: Mystic Blue and Mystic Silver for the Galaxy Book Pros, and Mystic Navy and Mystic Bronze for the Galaxy Book Pro 360s.

VERY THIN, VERY LIGHT

Did we say the Galaxy Book Pro laptops are thin and light? They are. The teeniest is the Galaxy Book Pro 13 (shown above), which at 1.93 pounds and 11.2mm thin (about $^{7}/_{16}$ inch) is light enough to forget you have it in your bag. The biggest is the Galaxy Book Pro 360 15, which at 11.9mm is still just shy of a half-inch thick. Its 3.06-pound weight is feathery for a 15.6-inch laptop.

"The new Galaxy Books are the thinnest 13-inch and 15-inch Intel Evo designs ever," Intel executive vice president Gregory M. Bryant said in a statement. All four laptops graduated from Intel's Evo laptop innovation program, meaning they had to meet requirements for performance, display quality, instant connectivity, and battery life. Everything about the Galaxy Book Pro laptops is state-of-the-art, from the AMOLED displays to the Thunderbolt 4 ports.

The only thing that isn't thinner is the S Pen bundled with each new Galaxy Book Pro 360. Unlike the slender stylus you've seen for Samsung's Galaxy Note products and a few earlier Samsung laptops, this new S Pen is 2.5 times wider, making it more comfortable for extended use. Of course, thinner laptops and fatter S pens mean there's no internal garage, as was possible with the stylus models, so you are sacrificing a little convenience.

Another potential liability of thinner laptops is typing experience. Samsung says

The Samsung Galaxy Book Pro 15 (shown in Mystic Blue) weighs a scant 3 pounds, which is light for a laptop of this size.

The new S Pen is 2.5 times wider than the traditional, stylus-like S Pen, offering a more comfortable writing experience.

the Galaxy Book Pro laptops all have 1mm of key travel. That's not much—we're used to 1.2mm to 1.4mm on mainstream laptops, and sometimes as much as 1.7mm on bigger, heavier models. Typing is a subjective experience, so we'll have to try it to decide whether Samsung's design is better in person than on paper.

Samsung is a leader in display technology, so we have high expectations for the AMOLED displays in the Galaxy Book Pro and Galaxy Book Pro 360 laptops. We do see, however, that the resolution for all models is simply FHD (1920x1080). This is plenty for a 13-inch laptop, but it could look grainier on a 15.6-inch laptop. We'll have to see how it actually looks if we're able to review one of the larger models.

One of the very few features that's a little disappointing is the integrated webcam. Its 720p resolution is still the most common to be found on laptops. Now that videoconferencing is a near-universal experience, however, 720p's shortcomings are becoming obvious. A 1080p webcam might have fit better into the overall premium makeup of the Galaxy Book Pro family.

The Samsung Galaxy Book Pro 360 15 (shown in Mystic Navy) comes with the new S Pen for writing and drawing.

SMART FEATURES AND INTEGRATIONS

Samsung built a lot of smarts into each laptop. The most intriguing is the Intelligent Performance Manager, which adjusts the laptop's fan, temperature, and battery behavior based on what you're doing with the laptop. While the default mode balances all factors, the laptop will prioritize performance for gaming and creative work, turn things down to save battery life, or turn off the fans entirely on battery if you need silence. Running a close second is the Intelligent Color Engine, which can adjust the color quality of your display depending on your activity (if the application you're using supports it).

The Galaxy Book Pro laptops integrate with other Samsung products. Using Link to Windows and Microsoft Your Phone, you can run up to five mobile apps from your Samsung smartphone on the Galaxy Book Pro, and send and receive text messages, phone calls, and notifications from your phone via the laptop. The Second screen feature lets you use a Galaxy tablet as an additional display. You can even manage SmartThings smart appliances through a Windows application. If you've already invested in the Samsung ecosystem, a Samsung laptop could be a handy addition.

GALAXY BOOK PRO, GALAXY BOOK PRO 360 SPECIFICATIONS

There's more to explore in these new Galaxy Book Pro and Galaxy Book Pro 360 laptops, and we hope to dig deeper if we're able to review a unit. For now, here are the specs for each new model.

Samsung Galaxy Book Pro 13

Starting price: $1,000
CPU: Intel 11th-gen (Tiger Lake) Core i5/Core i7 CPU
RAM: 8GB LPDDR4X
Storage: Up to 512GB NVMe SSD
Graphics: Intel Xe (integrated)
Display: 13.3-inch FHD (1920x1080) AMOLED
Ports/Connectivity: Thunderbolt 4, USB-C, USB-A, MicroSD, audio jack
Networking: Bluetooth 5.1, 802.11ax 2x2 Wi-Fi, Wi-Fi 6, Wi-Fi 6E-ready
Dimensions: 11.98x7.86x0.44 inches
Weight: 1.93 pounds
Battery: 65Wh
Colors: Mystic Blue, Mystic Silver

Samsung Galaxy Book Pro 15

Starting price: $1,100
CPU: Intel 11th-gen (Tiger Lake) Core i5/Core i7 CPU
RAM: Up to 16GB LPDDR4X
Storage: Up to 512GB NVMe SSD
Graphics: Intel Xe (integrated)
Display: 15.6-inch FHD (1920x1080) AMOLED
Ports/Connectivity: Thunderbolt 4, USB-C, USB-A, HDMI, MicroSD, audio jack

Networking: Bluetooth 5.1, 802.11ax 2x2 Wi-Fi, Wi-Fi 6, Wi-Fi 6E-ready
Dimensions: 13.99x8.89x0.46 inches
Weight: 2.31 pounds
Battery: 68Wh
Colors: Mystic Blue, Mystic Silver

Samsung Galaxy Book Pro 360 13

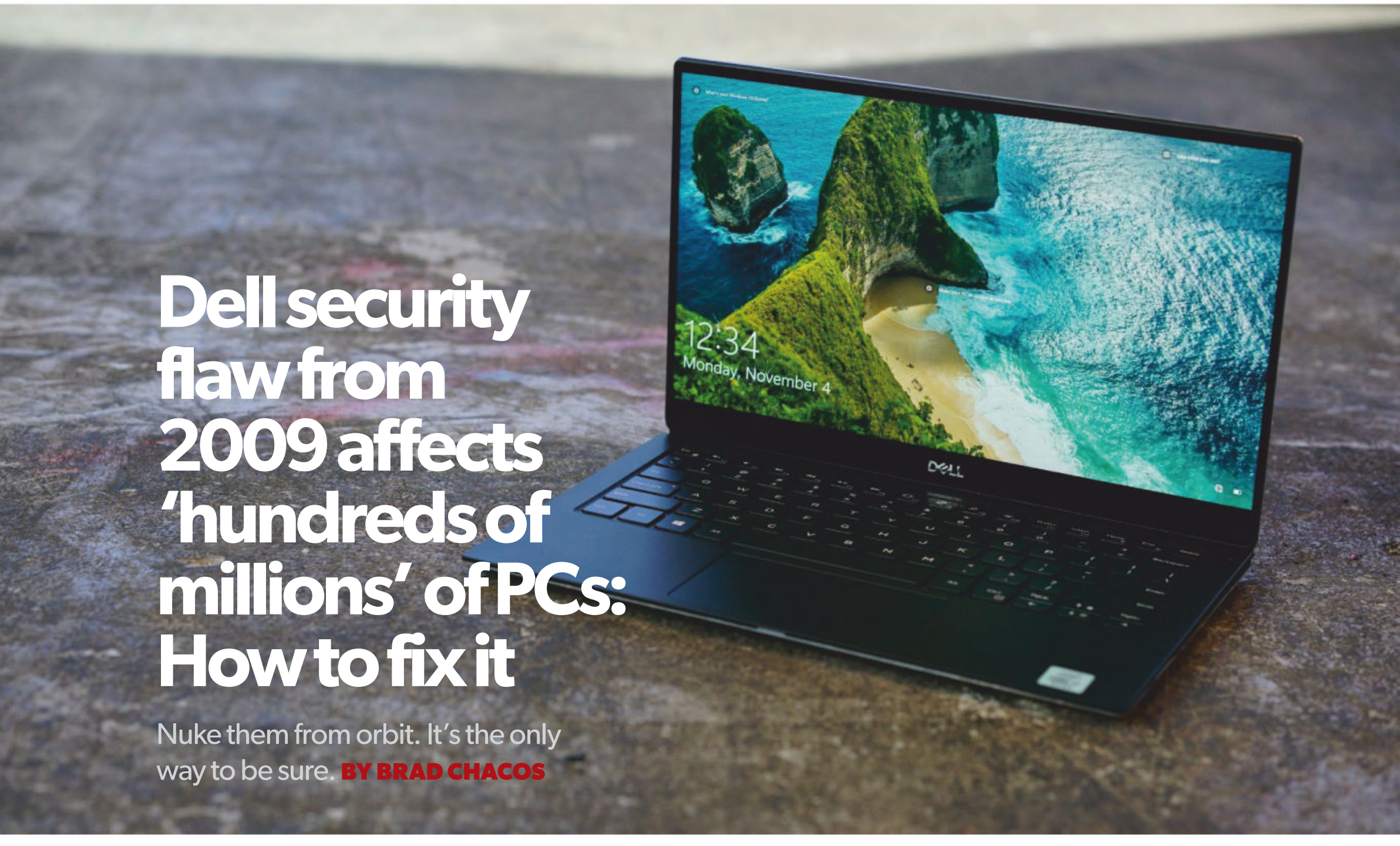
Starting price: $1,200
CPU: Intel 11th-gen (Tiger Lake) Core i5/ Core i7 CPU
RAM: 8GB or 16GB LPDDR4X
Storage: Up to 512GB NVMe SSD
Graphics: Intel Xe (integrated)
Display: 13.3-inch FHD (1920x1080) Super AMOLED
Ports/Connectivity: Thunderbolt 4, two USB-C, MicroSD, audio jack
Networking: Bluetooth 5.1, 802.11ax 2x2 Wi-Fi, Wi-Fi 6, Wi-Fi 6E-ready, 5G
Dimensions: 11.9x7.95x0.44 inches
Weight: 2.29 pounds
Battery: 63Wh
Colors: Mystic Navy, Mystic Bronze

Samsung Galaxy Book Pro 360 15

Starting price: $1,300
CPU: Intel 11th-gen (Tiger Lake) Core i5/ Core i7 CPU
RAM: 8GB or 16GB LPDDR4X

The Galaxy Book Pro 360 13 is shown in Mystic Bronze.

Storage: Up to 1TB NVMe SSD
Graphics: Intel Xe (integrated)
Display: 15.6-inch FHD (1920x1080) Super AMOLED
Ports/Connectivity: Thunderbolt 4, two USB-C, MicroSD, audio jack
Networking: Bluetooth 5.1, 802.11ax 2x2 Wi-Fi, Wi-Fi 6, Wi-Fi 6E-ready, 5G
Dimensions: 13.97 x 8.98 x 0.47 inches
Weight: 2.29 pounds
Battery: 63Wh
Colors: Mystic Navy, Mystic Bronze



Dell security flaw from 2009 affects 'hundreds of millions' of PCs: How to fix it

Nuke them from orbit. It's the only way to be sure. **BY BRAD CHACOS**

First, the bad news: Security researchers recently discovered five high-severity flaws in Dell's firmware update driver—and they've been pushed to customer computers ever since 2009. Now the good news: A fix is already (or finally?) available for people who own Dell desktops, laptops, and tablets.

You'll want to take advantage if you're affected, as the secretive code won't stay a secret for long. "These multiple high severity vulnerabilities in Dell software could allow attackers to escalate privileges from a non-administrator user to kernel mode privileges," writes Kasif Dekel (go.pcworld.com/ksdk), a security researcher at SentinelOne, which sniffed out the vulnerability. That could let attackers bypass security software or assault the network of an organization that deploys Dell PCs. "Over the years, Dell has released BIOS update utilities which contain the vulnerable driver for hundreds of millions of computers (including desktops, laptops, notebooks, and tablets) worldwide."

Yep, that's bad news all right—but it might not be quite as bad as it sounds. "At this time,

IMAGE: GORDON MAH UNG

SentinelOne has not discovered evidence of in-the-wild abuse," Dekel says. The company is withholding its proof of concept for the flaws until June 1 to give users time to get patched and protected.

Dell also says, "The vulnerability cannot be exploited remotely. A malicious actor must first obtain (local) authenticated access to your device." The need for an attacker to be physically sitting at your computer greatly reduces the practical reach of potential exploits, though these remain critical flaws that should be patched.

On that note, Dell just published a security advisory about the vulnerabilities (go.pcworld.com/secv), collectively identified as CVE-2021-21551 (go.pcworld.com/cv20), that offers several methods to fix the issues. There's also a helpful FAQ (go.pcworld.com/hlfq) written in plainer language. You'll need to eradicate the troublesome driver first, either by running the Dell Security Advisory Update - DSA-2021-088 utility (go.pcworld.com/dsup) or by manually removing the vulnerable dbutil_2_3.sys driver. By May 10, Dell's system management apps (go.pcworld.com/dmna), such as Dell Command Update, Dell Update, and Alienware Update, will also be able to perform the task. Nuking the file eliminates the threat.

Do it. "While we haven't seen any indicators that these vulnerabilities have been exploited in the wild up till now, with hundreds of million of enterprises and users currently vulnerable, it is inevitable that attackers will seek out those that do not take the appropriate action," Dekel says.

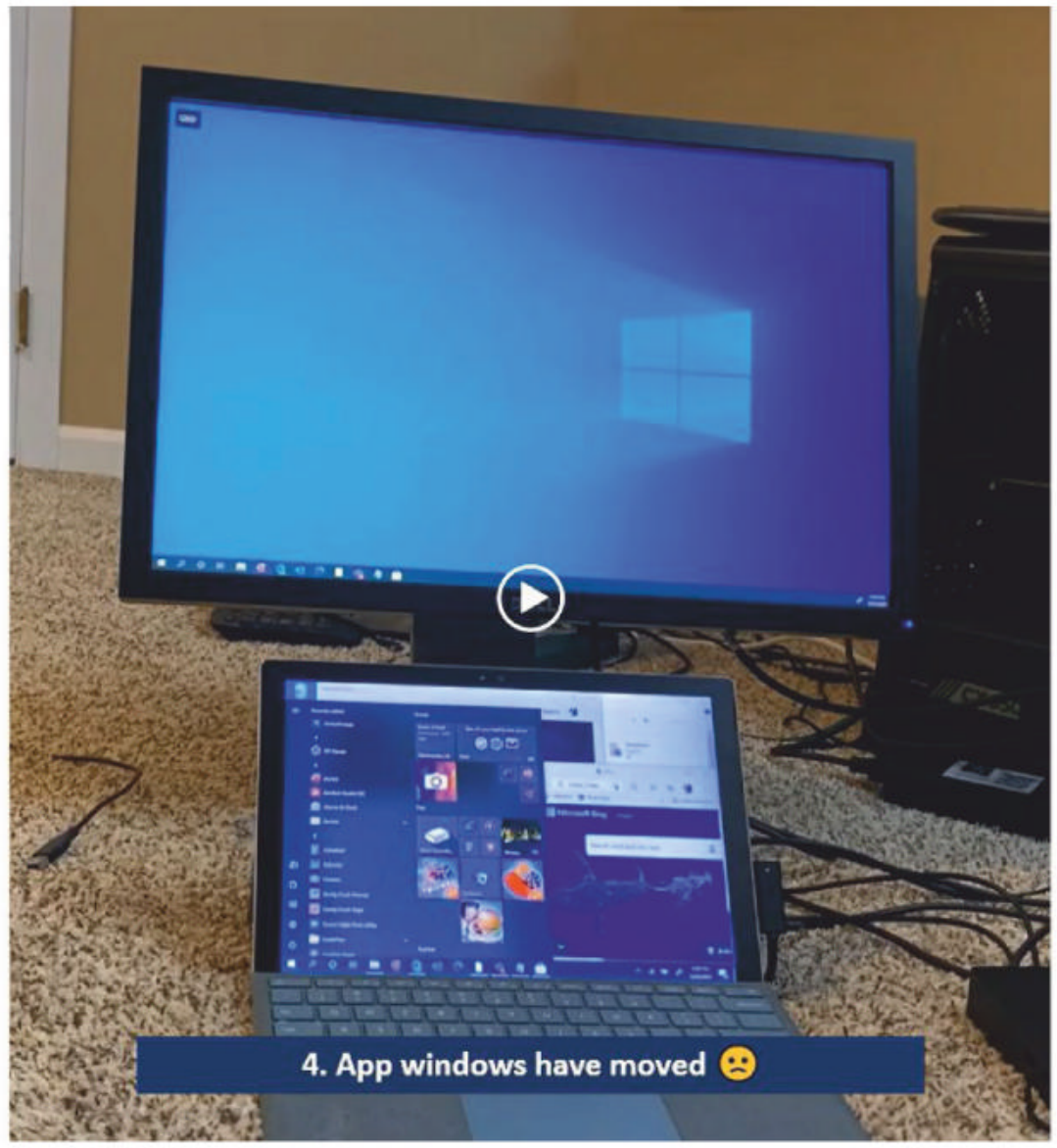
After you take care of that file, you'll need to install a fixed version of the software from Dell if you want to continue receiving firmware updates. Your system's preinstalled Dell management app *should* handle the process, but the exact details will depend on your system's configuration. Squashing a bug that dates from 2009 is complicated!

Currently, a fixed Windows 10 driver is available, and Dell says one for Windows 7 and 8.1 systems will be posted by the end of July. Older Dell systems beyond their end of life don't look like they'll be fixed, so be sure to delete that vulnerable driver on those systems. Dell says only the firmware updater, not other system hardware or software, uses it, so removing it shouldn't affect your system's performance in any way.

We strongly recommend visiting Dell's DSA-2021-088 security page (go.pcworld.com/dsup) for full details on the complex steps that are potentially needed to plug the hole (and to witness the truly staggering list of affected Dell computers). If you want more details about the flaws themselves, check out SentinelOne's disclosure (go.pcworld.com/snt1). And if all this vulnerability talk has the skin on the back of your neck crawling, our guide to the best Windows antivirus software (go.pcworld.com/gdav) can help ensure your system's security is in tip-top shape.

Microsoft is finally fixing Windows' most annoying multimonitor bug

Why can't Microsoft preserve your app layout when your PC resumes from sleep? Now it can. **BY MARK HACHMAN**

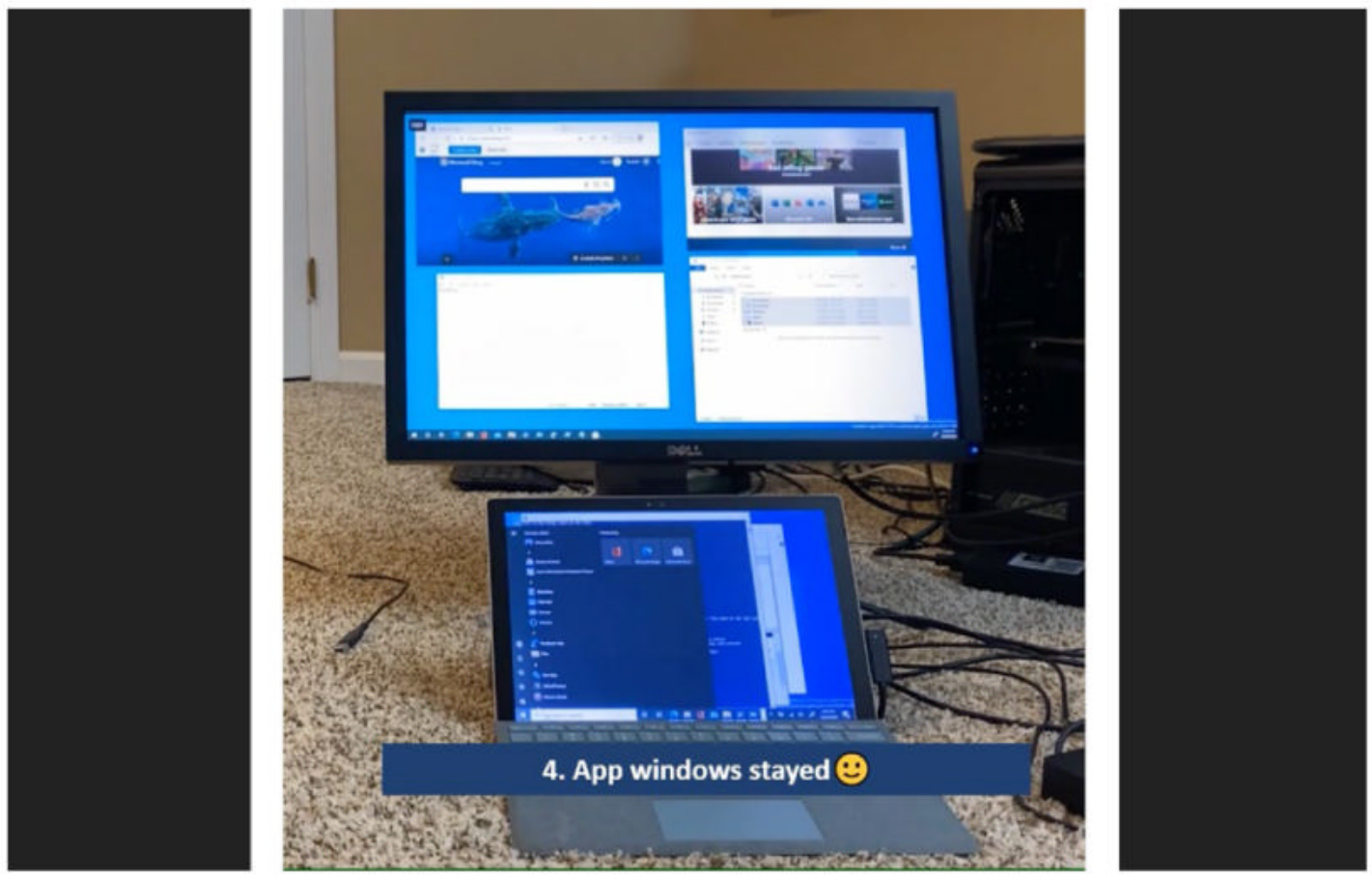


If you use multiple monitors with Windows, you've probably encountered this frustrating bug: When your PC resumes from sleep, all your application windows arbitrarily rearrange themselves. Microsoft is finally fixing this.

Microsoft calls this Rapid Hot Plug Detect (Rapid HPD), and it tends to affect multimonitor setups that can use the DisplayPort interface or that run DisplayPort over another cable, like Thunderbolt. Now Microsoft says an upcoming Windows update (go.pcworld.com/upup) will finally fix the problem.

Here's the scenario that Microsoft says the Windows update fixes: Your PC is connected to an external monitor, with apps scattered across all of the screens. Then you either put the PC to sleep or your PC falls asleep after you've left it alone for a while. When you return and your PC resumes from

IMAGE: MICROSOFT



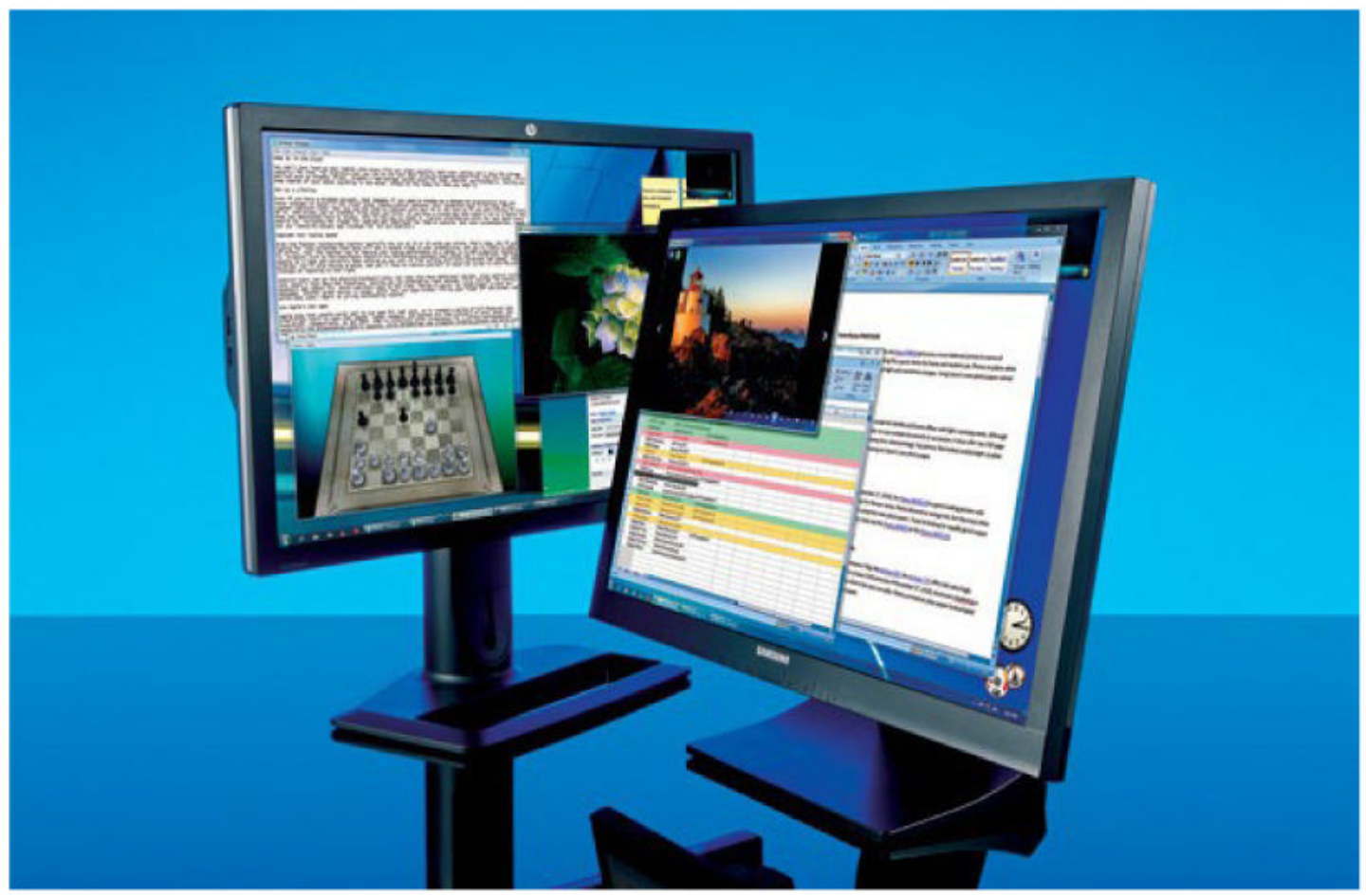
Microsoft says the issue will be fixed in an upcoming Windows update.

hibernation, Windows moves all of your applications to a single monitor, forcing you to rearrange them manually.

Unfortunately, Microsoft says that for now you'll have to be part of the Windows Insider program—specifically Windows 10 build 21287 or above—to take advantage of the fix. It's likely Microsoft will add this fix later to Windows 10's stable release, though the company isn't committing to it yet.

Thanks to The Verge (go.pcworld.com/tvrg) for noticing this.

Microsoft says that the fix should work with essentially every PC with multiple monitors, regardless of specifications, manufacturer, or connector type. That's good news for anyone who works with multiple monitors (go.pcworld.com/mulm), which we've encouraged you to do as a way to increase your productivity both at home and in the office.



The fix is great news if you use a multimonitor setup.

I've fallen in love with this Asus miniLED 4K panel

Take my money, Asus! **BY GORDON MAH UNG**

If you're the kind of person who puts doing work ahead of playing games, you'll understand why I think the Asus ROG Swift PG32UQX (go.pcworld.com/pq32) might be the perfect monitor.

Announced at CES 2020 (not 2021!) and finally due to ship by the end of May, the ROG Swift PG32UQX is a feature-packed panel possessing just about every acronym you can find, including miniLED, DisplayHDR 1400, IPS, 10-bit, G-Sync Ultimate, 144Hz, and 4K.

That's probably just alphabet soup to regular people, so let me translate it for someone who works more than they game—but is tired of staring at compromise every day in the form of some random 1080p LCD.

The top feature of the ROG Swift PG32UQX is its use of miniLEDs. These smaller, highly efficient light sources are still

IMAGE: ASUS

rare in PCs—we just saw the MSI Creator 17, the first laptop with a miniLED display (go.pcworld.com/crt7). Each of those miniLEDs means the ROG Swift carries a DisplayHDR 1400 logo and can hit a peak 1,400 nits in its 1,152 zones.

You have to see that brightness in game to appreciate it. I actually got to see the preproduction version (go.pcworld.com/prvr) as far back as CES 2020. Let me just say that when there's an explosion or a burning pile of wood in a video game, you don't just see it—you feel it, in person.

If I had this display, most of the time I'd just be using it to edit photos or run desktop apps, with the brightness set to about 500 nits. But when I'm ready to game, the brightness is there.

The panel technology itself is in-plane switching (IPS), known for its wide viewing angles and good color reproduction. Asus says the ROG Swift PG32UQX supports 98 percent of the DCI-P3 color gamut and is factory calibrated. It's also a true 10-bit panel and uses quantum-dot technology. All this matters to people who want precise color accuracy and aren't willing to make the sacrifice to get a panel that's great for gaming but not so great for working.

The ROG Swift PG32UQX is also a 4K panel that isn't overkill. A 4K 24-inch display is ludicrous, and maybe it's my eyes, but a 27-inch 4K panel is problematic too. With a 32-inch diagonal width, you get the perfect balance of high pixel density and enough screen so you can actually see those pixels. You're getting enough magnification that even old, tired eyes won't complain. Better yet, the screen features an antireflective coating to minimize glare and eye strain while working.

What makes the ROG Swift PG32UQX a gaming panel, though, is its support for G-Sync Ultimate. Yes, that means AMD Radeon fans are out of luck, but if you run a GeForce graphics card, the panel will sync up variable refresh rates all the way down to 1Hz.

You get DisplayPort, three HDMI ports, and plenty of USB ports. That jog dial lets you easily change monitor settings.

That's especially useful for those who want to play a game at the native 4K resolution, where it'll appear the sharpest, but want the chuggy parts of a game where frame rates dip to 42 fps to be less annoying.

I also appreciate that while many 4K monitors for work typically top out at 60Hz, the ROG Swift offers up to 144Hz refresh rates. That falls far short of panels that can run at 360Hz, but most of those panels aren't going to offer 10-bit, factory-calibrated color accuracy either.

For ports, the ROG Swift gives you one DisplayPort 1.4, three HDMI 2.0b, three USB 3.0, one USB 2.0, and a 3.5mm analog headset jack. The three HDMI 2.0b ports would be limited to 4K at 60Hz, which is the maximum of the spec. The single DisplayPort 1.4 would max out at 4K at 120Hz, but by supporting VESA Display Stream Compression the panel will hit its 4K at 144Hz resolution and refresh rates.

The use of DSC also means you'll need a GPU that supports it. That includes GeForce 30-series and 20-series cards as well as Radeon RX 5000-series and 6000-series cards.

The monitor supports standard VESA mounts.

The panel also supports a VESA mounting system and includes a tiny OLED for monitor status on it. Even niftier: There's a tripod socket on top for mounting a camera as well as a USB-A to plug that camera into.

Is it the ultimate production panel? No, far from it. There are displays likely far better suited for production work. But most of those aren't exactly great gaming panels, either. What you get here is just the right amount of features to make both working and gaming equally joyful.

The biggest complaint from all will be the price. While my mouth says yes, my wallet says no, because the list price of the ROG Swift PG32UQX is $2,999. Although we were initially told the panel would cost $2,999.99, Asus will give you a great deal and let you keep the 99 cents.

Microsoft is killing my favorite Windows 10 feature

Windows 10's Timeline is losing its cross-device sync, a killer productivity feature, and I'm crushed. **BY MELISSA RIOFRIO**

Microsoft is killing one of my most beloved Windows 10 features, a versatile tool that I use every single day, and I am incredibly sad about it.

I've recommended Windows 10's Timeline tool (go.pcworld.com/tmtl) over and over again, calling it a truly helpful feature you don't know about (go.pcworld.com/10hp) and recommending it as a key Windows tool to supercharge your productivity (go.pcworld.com/sprc). Timeline shows you a chronological history of your recent activity in supported key apps, including individual Office files, images, and browser tabs in Edge or Chrome. Clicking one of the files or webpages shown in Timeline opens it back up, making it dead simple to jump back into something you were working on before.

IMAGE: iSTOCK

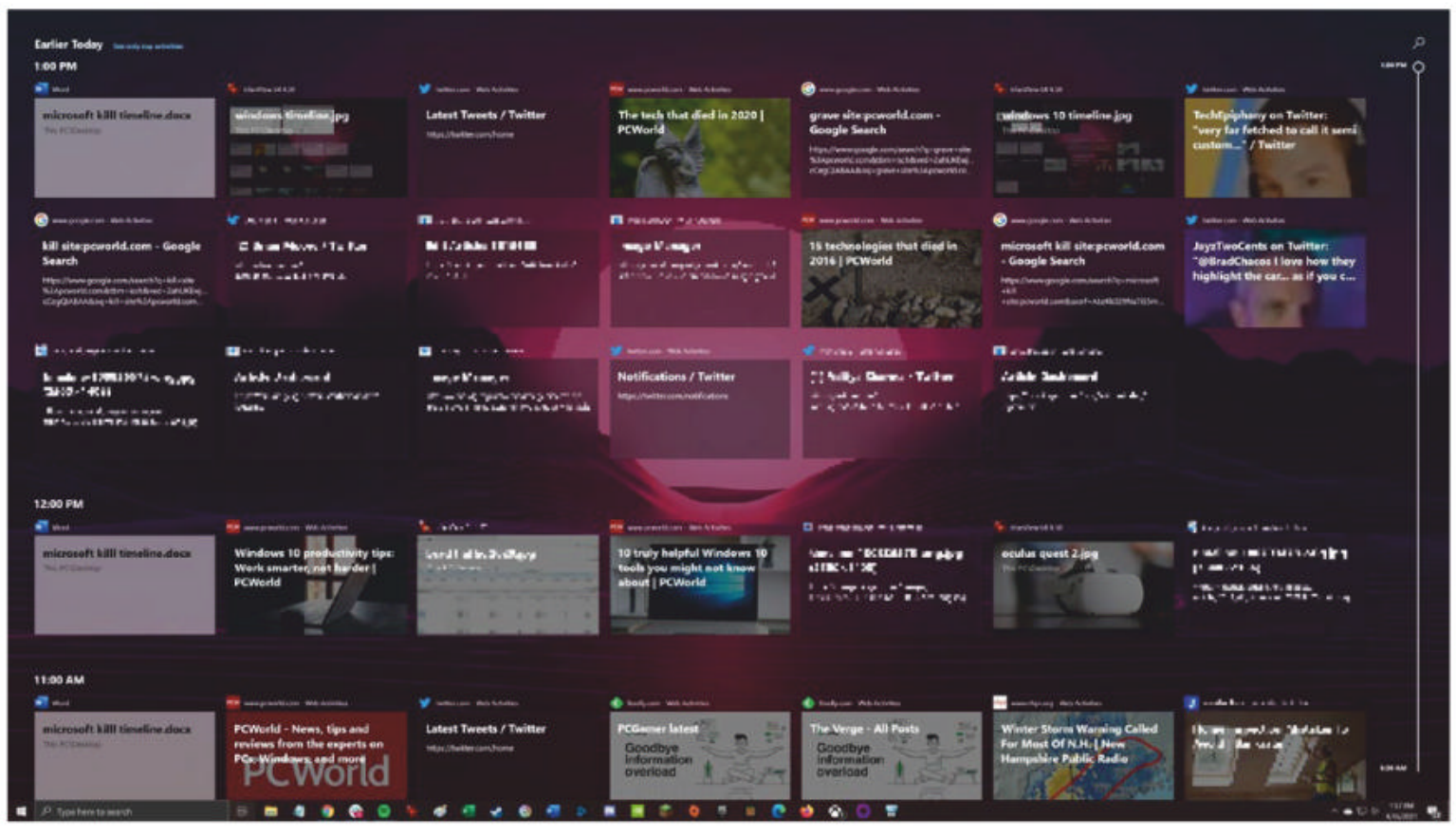
The best part of Timeline is its cross-device syncing functionality. The feature hooks into your Microsoft Account to show your activity across all devices you've signed into. If you've been working with cloud-saved Office files, images, or several browser tabs on your desktop, Timeline makes it so you can open your laptop from your couch and pick up where you left off in mere seconds (assuming you have the same software and services installed on both computers). "Paired with the 'Pick up where you left off' in modern Microsoft Office apps, you can be knee-deep in that project from two weeks ago in no time," I've said in the past. It's an utterly fantastic feature for a multidevice world.

But not for much longer.

Microsoft quietly tucked a bombshell into the notes of a recent Windows Insider preview build (go.pcworld.com/b213): "If you have your activity history synced across your devices through your Microsoft account (MSA), you will no longer have the option to upload new activity in Timeline….To view web history, Edge and other browsers have the option to look back at recent web activities."

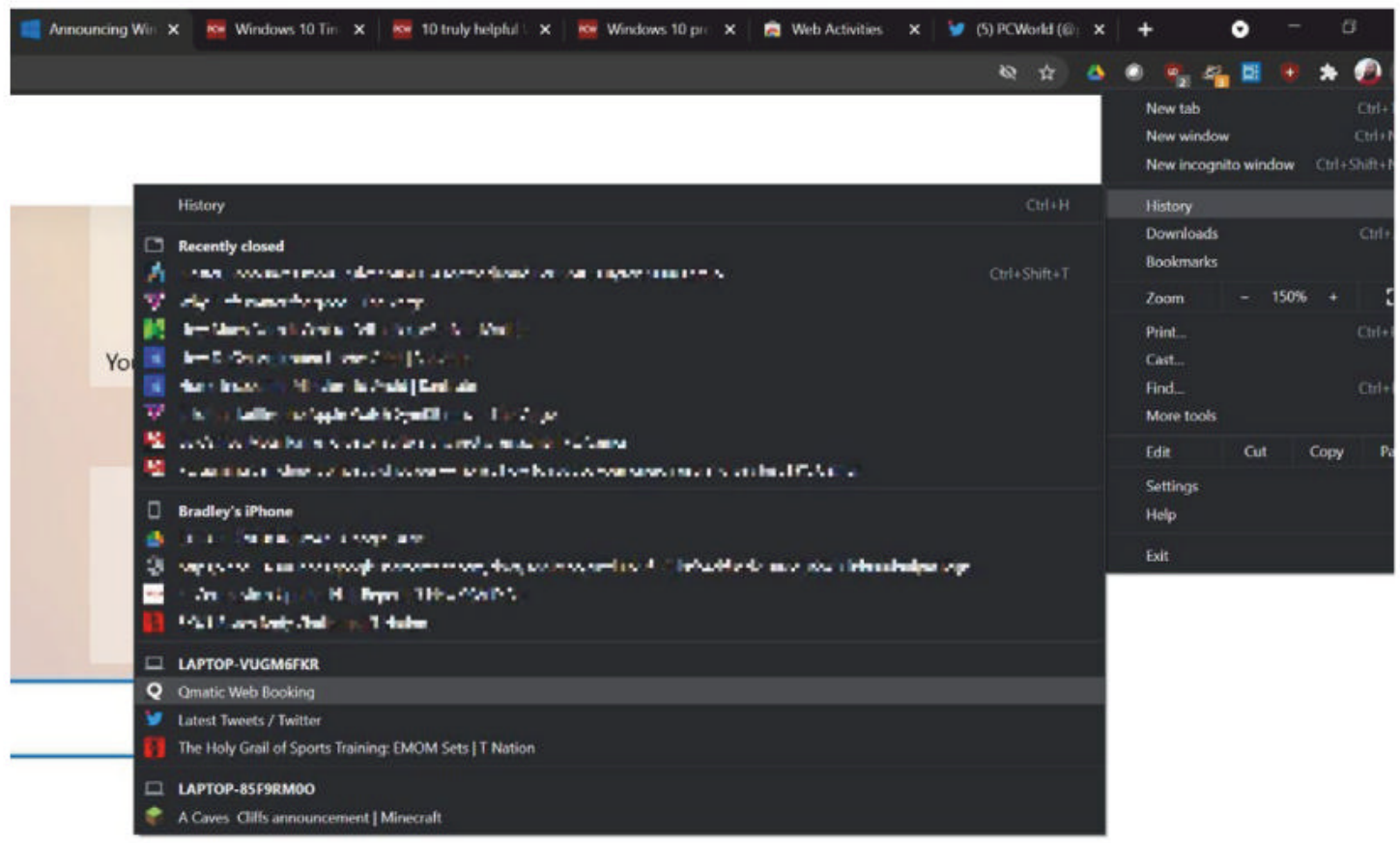
In other words, Timeline's cross-device syncing—the entire reason I use the tool—will be going away, assuming this Insider preview tweak winds up in Windows 10's official release builds in due time. That *really* sucks.

Yes, most of Windows Timeline's syncing functionality can be replicated by individual apps, but in a kludgy and clunky way. If you're signed into Chrome, its history settings show you recent tabs across sessions on all your devices, letting you pick and choose ones to reopen on your current computer. And if you're storing Office files in Microsoft's OneDrive—which you need to do to take advantage of Timeline anyway—you can open up Excel or Word or PowerPoint and simply use the file browser to open the file from its location in your cloud storage.



Windows 10's Timeline feature in action.

All of that takes *significantly* more effort and clicks than simply pressing Windows Key + Tab and selecting the files or tabs you were just working on from your other device or computer. Windows Timeline syncing made it seamless, simple, and speedy. I will miss it greatly.



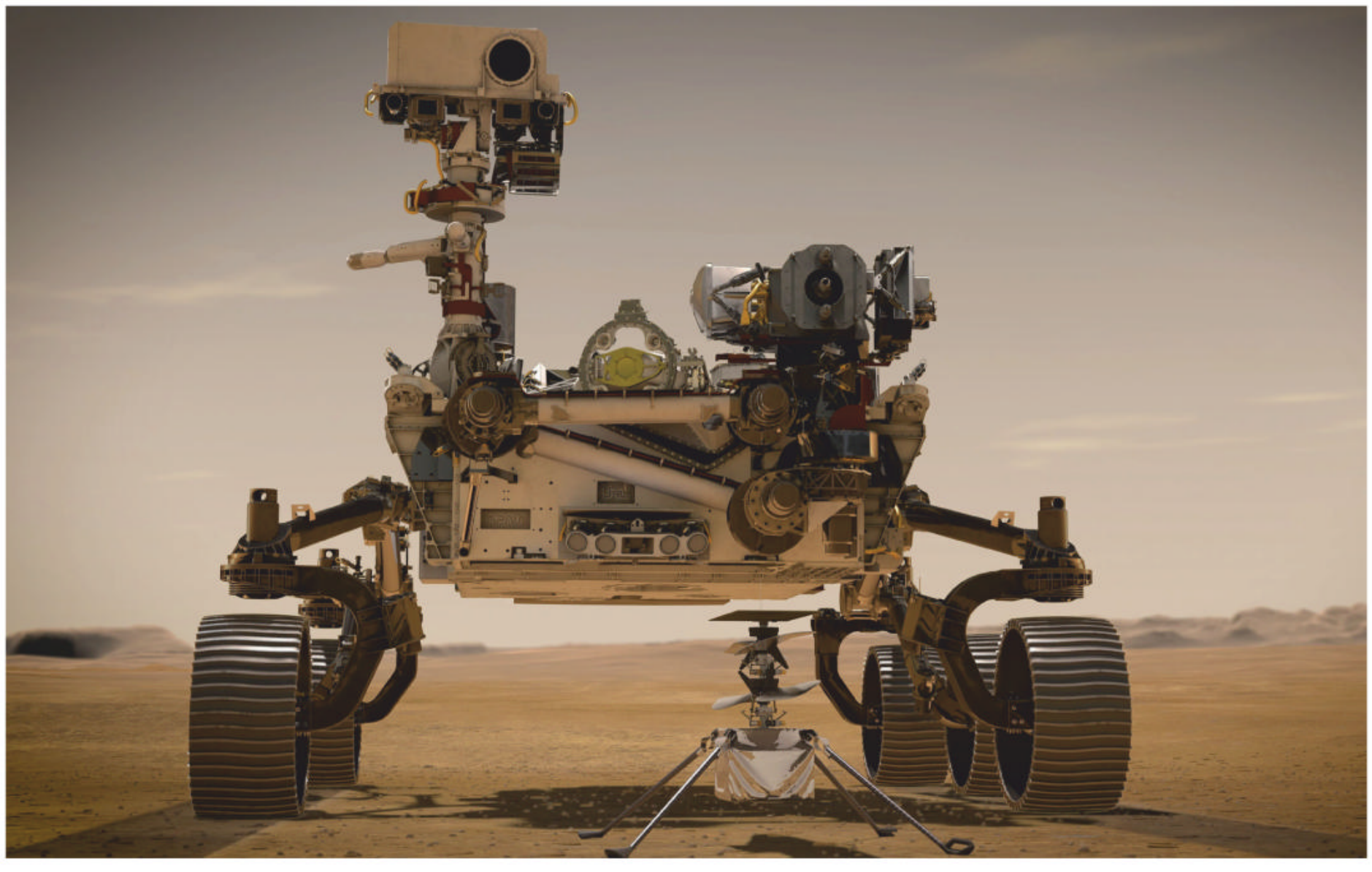
Sifting through individual tabs to reopen them via your browser's web history is nowhere near as quick or seamless as Windows 10's Timeline feature, but Chrome's extensive options might take some of the sting away.

Timeline isn't going away completely. After an uproar following the announcement, Microsoft updated its Windows Insider post to note that "Timeline and all your local activity history still remain on Windows 10." In other words, Timeline itself will still work, but only for the specific PC you're on. If you move from your desktop to your laptop, your laptop's Timeline will only be populated with a history of tasks you've performed on that very notebook, rather than a comprehensive list that wraps in activity from your desktop and other devices.

That might be helpful for some folks, but cross-device syncing was the feature that made Windows Timeline truly special, and the tool will be rendered utterly useless to me without it. Alas.

Microsoft hasn't announced an official planned end for Timeline's cross-device support, much less an execution date, but it's clear that syncing is a dead feature walking. Considering that Microsoft's Web Activities Chrome extension (go.pcworld.com/chrx)—needed to hook Google's browser into Timeline—only has 30,000-plus users while both Windows 10 and Chrome have each been installed hundreds of millions of times, I guess this shouldn't really come as a surprise. Guess I'm one of the few who loves the feature so deeply.

Pour one out. Timeline was fun (and incredibly productive) while it lasted. Just leave the criminally underutilized Virtual Desktops feature alone, Microsoft (go.pcworld.com/sprc). Please?



Finally, a good use for Intel's lowly Atom CPU: Inside NASA's $2.7B Perseverance rover

The Atom had to go to Mars to get some respect. **BY GORDON MAH UNG**

Intel's underpowered Atom CPU has finally found some respect—but it had to go all the way to Mars to get it. The lowly chip had a tough time on Earth, winning the faintest of praise for its pedestrian performance. But its energy-sipping ways were apparently a good fit for a couple of compute modules that NASA built into its $2.7 billion *Perseverance* rover.

Intel said that there are at least two Atom SoCs embedded inside the *Perseverance* (go.pcworld.com/2atm). The chip is the main processor aboard a COMEX-IE38 computing module developed by Israel-based CompuLab. The COMEX-IE38 is built around Intel's 22nm Atom E3800 and runs up to 8GB of DDR3 and 64GB of storage along with Gigabit ethernet, PCIe, SATA, USB, and serial UARTs.

IMAGE: NASA

It's long been a running joke that the Apollo moon missions used less computing power than a TI calculator provided, but anyone who has memories of the Netbooks powered by Atom may think an Atom might have been even slower.

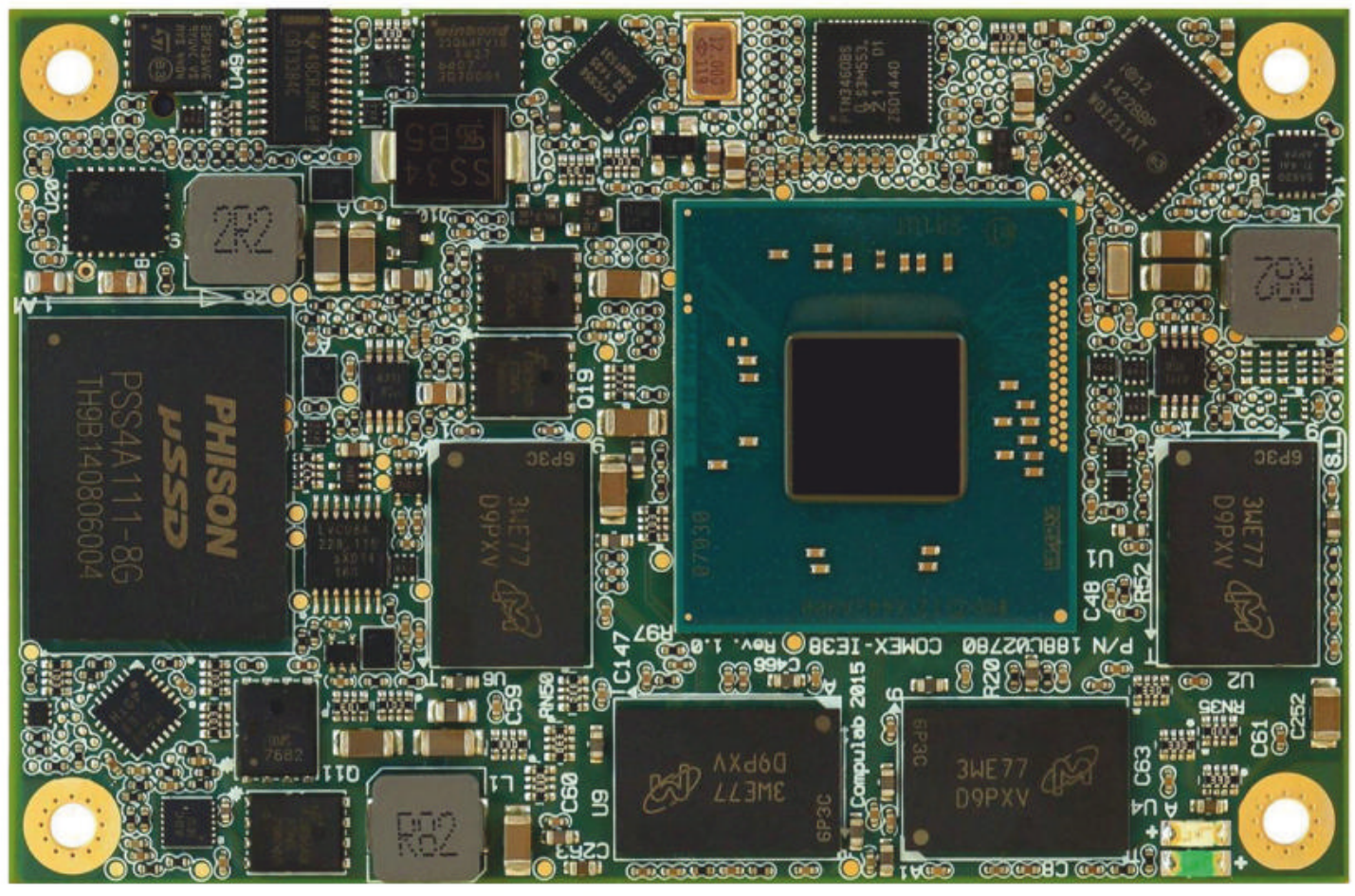
Atom might be the butt of jokes for hardware snobs, but the crazy thing is it's about 12 times faster than the chip that handles the main processing for the probe: a 1998-era PowerPC 750 (go.pcworld.com/pr75). That's a single-core chip running at maybe 233MHz. The PowerPC 750 was used for the original iMac until Apple abandoned ship for Intel's x86 chips in 2006. In this case, it is BAE's RAD750 (go.pcworld.com/rd75) rated for 266 MIPS. If you doubt an Atom could run circles around the PowerPC, consider this: an Atom E3800 can hit 3,300 MIPS.

So yeah, snark all you want about that Atom SoC, but it's actually one of the higher-performing chips aboard the probe. The COMEX-IE38 powers two data storage units, which take all of the raw data from the probe's 23 cameras by ethernet and handle the compression of the images before being sent to 480GB SSDs and then on to NASA.

LOW-BID CONTRACT?

If you're wondering why a $2.7 billion space probe would pack long-obsolete hardware, it's not some government low-bid contract rule at play (not necessarily, anyway). It's likely due to the radiation resistance required for traveling the millions of miles from Earth to Mars and then operating under incredibly inhospitable conditions. The RAD750, for example, has a price tag of about $280,000.

In the case of the Atom-based COMEX-IE38, taxpayers got a deal, as Intel notes you can buy them for about $150.



The COMEX-IE38 card aboard NASA's Perseverance lander stores and sends images from the probe and runs on the much-maligned Intel Atom CPU.

>> 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.

>> Come together at lovehasnolabels.com

love
has
no
labels.

ad COUNCIL

29.7604° N, 95.3698°, W SFC 134

Surface Laptop 4: Microsoft returns to form with solid notebook

Microsoft's Surface Laptops have delivered once again.

BY MARK HACHMAN

Microsoft's Surface Laptop 4 has significantly improved where it matters—in performance and in battery life. Even though it's largely unchanged otherwise compared to the Surface Laptop 3 (go.pcworld.com/srf3), and is available in the same 13.5-inch and 15-inch sizes, that stability is not a bad thing given the product line's tradition of offering a great screen, a great keyboard, and great battery life. Microsoft has hit its mark on all three criteria once again, and the important changes under the hood make all the difference.

Our praise comes with a few qualifications. The product line is expensive. The long battery life is attained with a few tricks. We also don't know how the Ryzen 7 version we've tested here compares to its siblings with an Intel CPU inside. Despite these unknowns, we would still easily recommend buying this laptop.

BASIC FEATURES

Microsoft's Surface Laptop 4 offers a surprising diversity of exterior design options:

IMAGE: MICROSOFT

size (13.5-inch versus 15-inch models), finish (clad in metal or Microsoft's signature Alcantara fabric), and color. We've listed the available combinations and prices in our original news story announcing the Surface Laptop 4 (go.pcworld.com/ans4).

One thing we appreciate about the Surface Laptop 4 is that there's really no "gotcha" configuration—they're all good. Our review unit retails for about $1,500 on Amazon (go.pcworld.com/15az). However, if you'd like to pay a little less for a model with 8GB of RAM and 256GB of storage, that's an option as well.

We received a review unit of the 15-inch Surface Laptop 4 in a Matte Black, metallic configuration. It's so visually identical to the Surface Laptop 3 we reviewed previously that we were tempted to attach sticky notes to distinguish the two.

Processor: Core i5-1135G7, Core i5-1145G7, Core i7-1185G7; Ryzen 5 4680U Surface Edition, Ryzen 7 4980U Surface Edition (as tested)

Display: 13.5-inch (2256x1250, 201 ppi); 15-inch (2496x1664, 201 ppi, as tested) PixelSense with touch

Memory: 8GB/16GB/32GB LPDDR4X (3,733MHz); 8GB/16GB (as tested)/32GB DDR4 (2,400MHz)

Storage: 256GB/512GB (as tested)/1TB M.2 NVMe SSD

Graphics: Iris Xe/AMD Radeon Graphics (as tested)

Ports: 1 USB Type C, 1 USB Type A, Surface Connect, 3.5mm jack

Security: Windows Hello camera

Camera: 720p (user-facing)

Battery: 45.8Wh (design), 46.6Wh (full charge)

Wireless: Wi-Fi 6 (802.11ax), Bluetooth 5.0

Operating system: Windows 10 Home (consumer, as tested)/Windows 10 Pro (commercial)

Dimensions: 13.5-inch: 12.1x8.8x0.57 inches (14.5mm); 15-inch: 13.4x9.6x0.57 inches (14.7mm)

Weight: 13.5-inch: 2.79 pounds (Cobalt Blue, Platinum) to 2.84 pounds (Sandstone, Matte Black); 15-inch: 3.4 pounds (Platinum, Matte Black, as tested). Add approximately 0.64 pound for the AC adapter.

Colors: Matte Black (as tested), Platinum, Cobalt Blue, Sandstone

Prices: $999 to $2,499; $1,529 (as tested) from the Microsoft Store (go.pcworld.com/mss4) and Amazon (go.pcworld.com/15az)

The Surface Laptop has always been Microsoft's minimalist response to the Apple MacBook, and that's still apparent. With a flick of your finger, you can lift the lid. Tap the power button, and you're off. The OOBE (out-of-the-box experience) asks for your Microsoft account to smooth the process, though you can create a local account with a little finagling. You're encouraged to enter your Android phone's number to set up Your

This is Microsoft's last-generation Surface Laptop 3, which is visually identical to the new Surface Laptop 4.

Phone, to enter your Microsoft account to set up Office, and to tell Microsoft how you plan to use the Laptop to customize the user interface. The latter option is still a bit of a mystery, because you have essentially one chance to tell Microsoft if you plan to use the Laptop as a gaming PC, for productivity, or something else—or even all three. I usually opt for all of the options to be on the safe side, but some additional documentation, examples, or just a chance to reconsider your choices would be handy.

Once open, the Surface Laptop 4 exudes a clean aesthetic. There aren't even any stickers advertising the processor or audio technology, as you'll often see on other laptops. There's the keyboard, the trackpad, and just bare metal surrounding it. The 15-inch model we tested provides seemingly acres of space for your palms. The metallic finish does attract some fingerprints, though they're easily wiped away.

There's a lot to be said for the dimensions of the Surface Laptop 4 as well. Lacking discrete graphics, the shell tapers down to just 14.7mm (rated). While I've never been especially picky about how thin a laptop is, I do care about how light it is. A 3.5-pound 15-inch laptop feels comfortable in your hand and in your backpack.

Microsoft usually does an excellent job of cooling its Surface Laptops. Like the Surface Laptop 3, this year's Surface Laptop 4 includes fans that rarely turn on and run quietly when they do. You'll hear the fan kick on more strongly during light gaming. As our performance section indicates, both the CPU and GPU appear thermally limited—performance appears to diminish somewhat over time as heat builds under intensive load. With everyday tasks, however (web browsing, Office work), throttling shouldn't be an issue.

Microsoft's configuration options affect

The Surface Laptop 4's port arrangement is minimal: USB-C, USB-A, and a headphone jack.

the Laptop's behavior. Out of the box, our review unit was set to "best battery," even when plugged in. The Windows power/performance slider makes a difference! Performance will significantly increase if this is adjusted upward.

Microsoft's display helps sell the Surface Laptop 4, too. With most laptops you'll choose between 1080p and 4K options. At 2496x1664, the 15-inch Surface Laptop 4 falls somewhere in the middle, and there's nothing wrong with that. Using a SpyderX Elite colorimeter, we found that the Surface Laptop 4 covers 95 percent of the sRGB color space and 70 percent of AdobeRGB. Both "enhanced" and "sRBG" display modes are available.

But Microsoft made a notable change in display brightness from the Surface Laptop 3 to the Surface Laptop 4. On battery, the Surface Laptop 3 maintained its set brightness when switching from wall power to battery power. In the Surface Laptop 4, it does not. On wall power, the maximum display brightness was 390 nits, and on battery power, the maximum display brightness dropped to 234 nits. Dropping the brightness level can make the display harder to read in bright light and in this case really eliminates the option of working outdoors.

Microsoft left the ports unchanged from the Surface Laptop 3: There's both a conventional USB-A and a conventional USB-C. There's no Thunderbolt support, which blocks the Surface Laptop 4 from accessing the growing ecosystem of Thunderbolt docks. Instead, Microsoft offers

Microsoft has left the Surface Connector in place, too.

a pair of Surface Docks from which to choose, both of which use the legacy Surface Connector on the right side of the Laptop.

Microsoft executives told PCWorld they settled on maintaining the Surface Connector for several reasons. First, several generations of Surfaces have used it as a power connector.

Color options on the Surface Laptop 4 include Matte Black, Platinum, Cobalt Blue, and Sandstone.

They're also quite proud that it's magnetically connected, which helps prevent accidental yanking off of Surface devices. Finally, they specifically called out Thunderbolt cables as being easily jarred, which we've also found to be the case in our anecdotal experience.

Microsoft doesn't ship the Surface Laptop 4 with a Kensington lock or an SD card slot. We've also confirmed that while the Surface Laptop 4 may have a replaceable SSD, it unfortunately isn't accessible to users, as it is on the Surface Pro 7+ tablet (go.pcworld.com/s7pr).

KEYBOARD, WEBCAM, AUDIO EXPERIENCE

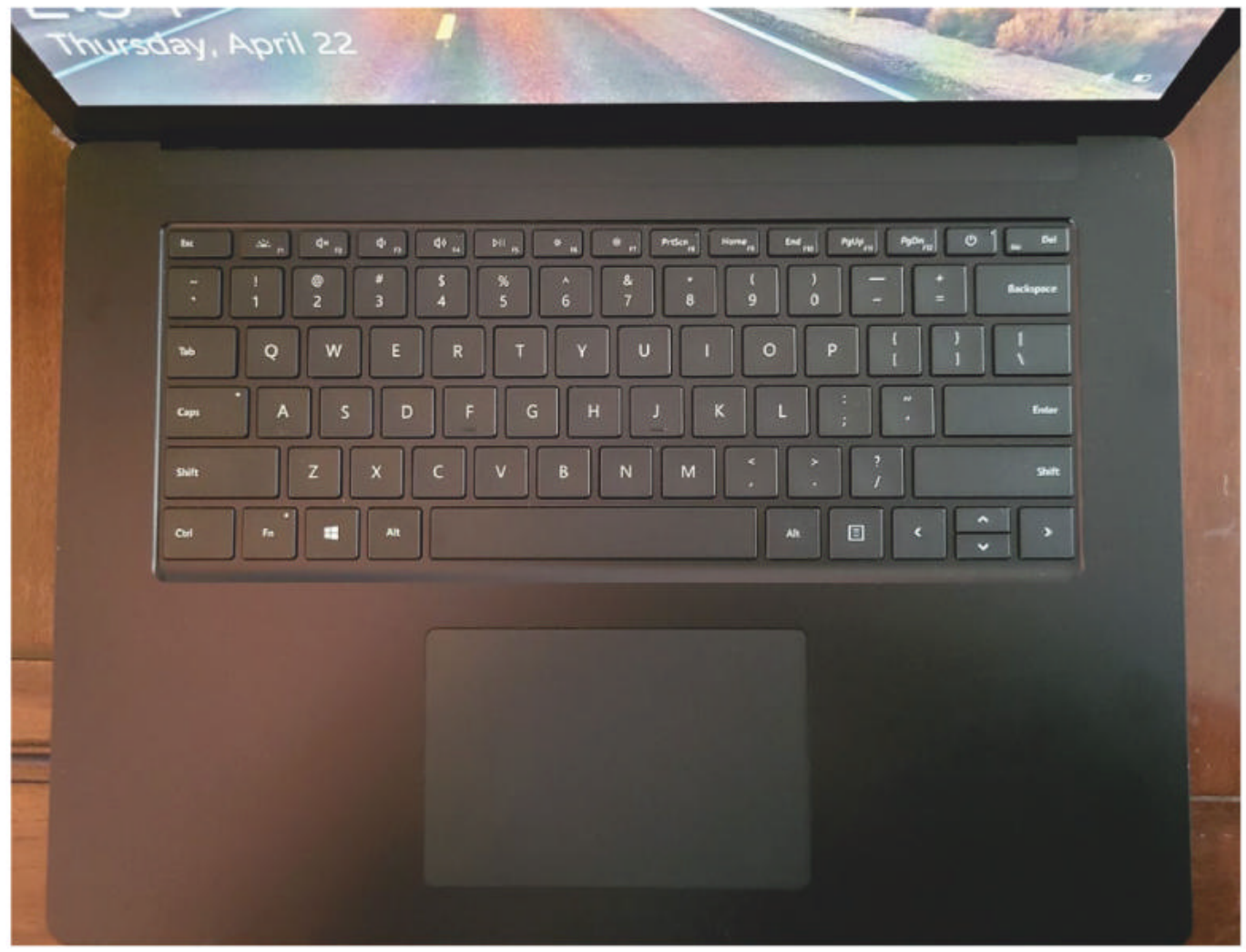
The audio experience on Microsoft's Surface Laptop 4 is absolutely solid. If you're someone who likes to play with graphics equalizers and tweak your laptop's audio, though, you'll be frustrated.

Other laptop manufacturers typically bundle audio enhancement software. The Surface Laptop 4 boasts what Microsoft calls omnisonic speakers, with Dolby Atmos audio built in. (Microsoft notes that Dolby Atmos kicks in only with audio specifically set up to support it.) Microsoft claims (go.pcworld.com/mclm) that you can download the Realtek app to fine-tune the audio, but the Microsoft Store generated an error message when I tried to download the app.

The good news is that I don't think you'll need it. Few, if any, laptops deliver a robust low-end bass sound, but everything I played back on the Surface Laptop 4 sounded rich, tonally accurate, and pleasant. The Surface Laptop 4 is one of the few laptops I think you

could tolerate even without headphones.

My initial reaction to the Surface Laptop 4's keyboard was that some of the keys, particularly the Tab key and some of the other big keys (Caps Lock, Shift) on the left side of the keyboard, were a bit floppy. Otherwise, the keyboard seems exactly the same as on previous Surface Laptops.



The Surface Laptop 4 keyboard.

I've slightly soured on my feelings that the Surface keyboards are the best in the industry, ever since Microsoft reduced the key travel to 1.3mm, offering less cushion. Still, I think you'll find the Surface Laptop 4's keyboard perfectly competent, if not as luxurious as other keyboards I've tried.

The Precision trackpad, as usual, is close to perfection: big, glassy smooth, and clickable essentially all the way up and down. Gestures worked without a hitch.

The Surface Laptop 4's 720p webcam remains essentially the same as before. (For those who want a higher-resolution integrated Surface webcam, the Surface Pro 7+ has a 1080p webcam [go.pcworld.com/10wb]. Microsoft has also launched its own 1080p standalone webcam that can clip onto a Surface or other laptop.) Like all Surface devices, the webcam includes a depth camera to log you in by recognizing your face. It worked superbly.

Webcams with 720p resolution are typical for the majority of laptops, and you're probably used to seeing the slightly soft images of friends and colleagues who use them. What the Surface Laptop 4 offers is solid color balance and exposure, plus the correct positioning at the top of the screen—never buy a laptop with a webcam embedded in the keyboard!

Microsoft may have quietly done away with the crapware-free Signature Editions of laptops and tablet it used to sell via its online store, and I was happy to see that there was

essentially no preloaded crapware on the Surface Laptop 4. The setup experience recognizes whether you have a current Microsoft 365 subscription, and allows you the option of downloading the updated Office apps.

The Start menu app list pares everything down to the bare essentials, but there's a Play grouping of icons that serve as shortcuts to download apps such as Roblox, Solitaire, Yahoo Messenger, and more.

PERFORMANCE

We expected that the transition to AMD's excellent Ryzen 4000 Mobile series would translate into dramatically increased performance, and we weren't disappointed. Microsoft also promised significant battery-life improvements and generally delivered there as well.

In the week or so that we reviewed the Surface Laptop 4, we noticed very little that would slow it down. We were able to perform Office work, stream audio and video on the web, and more, without a hitch. One of the more demanding tests we run is to stream a 4K video from YouTube at 60 frames per second across a Wi-Fi connection, and note any drops in frames. The SL4 dropped an imperceptible 4 frames per 10,000, which is just about perfect.

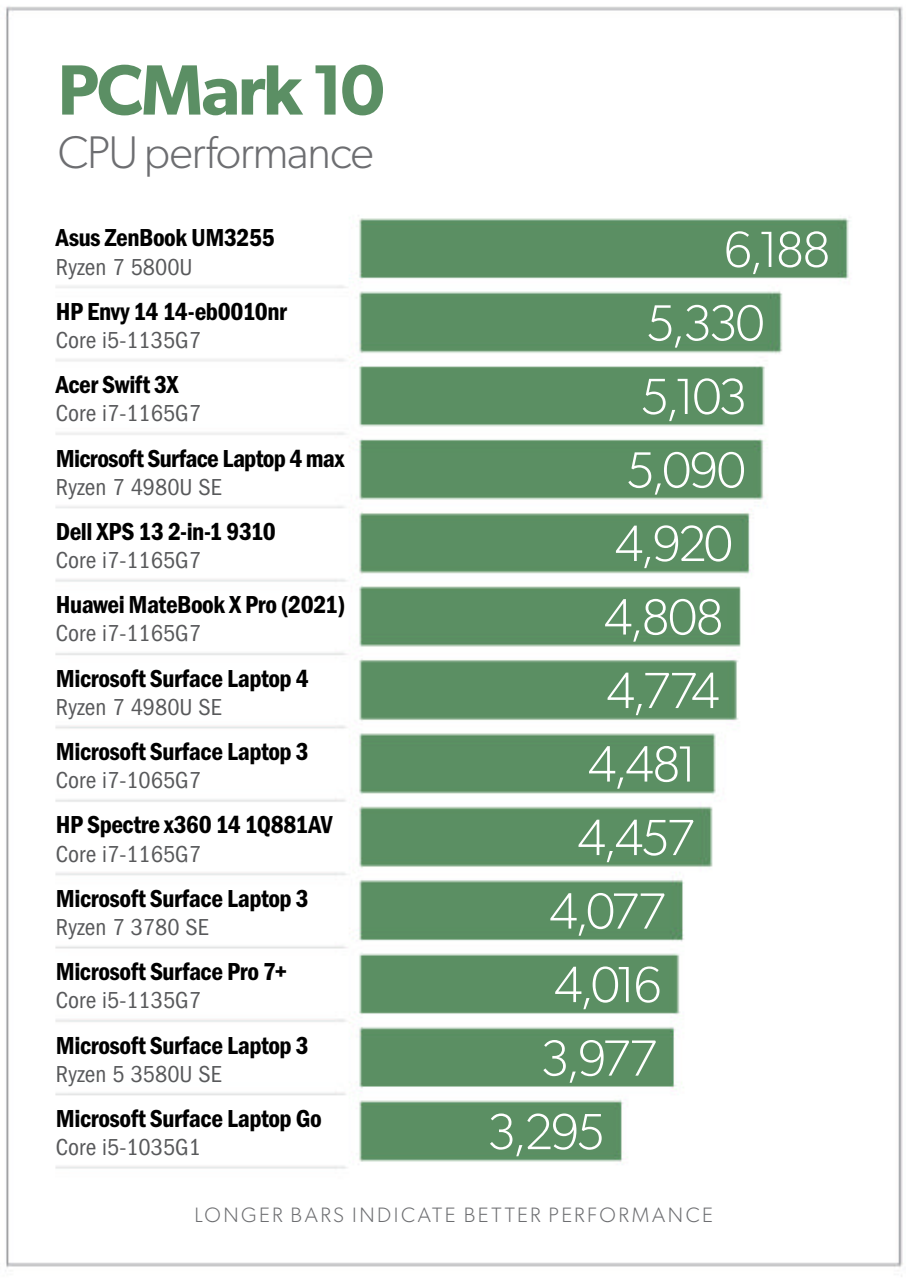
As we'll demonstrate below, the Surface Laptop 4 accommodates gaming at moderate levels of image quality, even at native resolution, which is really handy in a world where GPUs are nowhere to be found. Still, those tests revealed that the Surface Laptop 4's CPU outclasses its integrated GPU by a significant amount, offering room for future improvement.

While we limited our first Surface Laptop 4 performance estimates (go.pcworld.com/pfes) to a subset of Surface PCs, we've expanded our comparison here to include rival laptops. Take a look at the $1,200 Acer Swift 3X (go.pcworld.com/sf3x), the $1,715 Dell XPS 13 2-in-1 9310 (go.pcworld.com/xs13), and the $1,210 HP Envy 14 (go.pcworld.com/ev14) for comparison's sake.

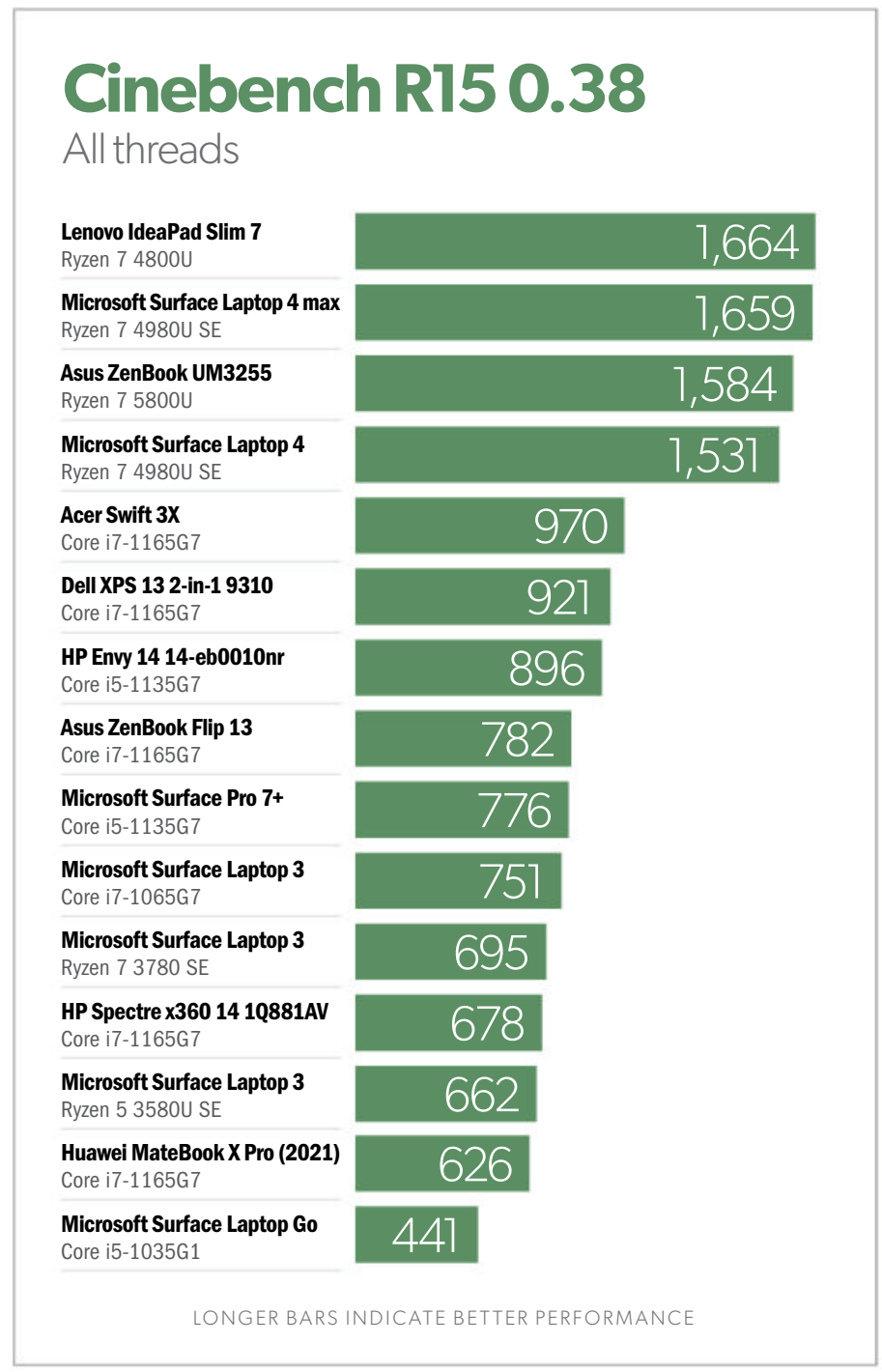
Keep in mind that, for whatever reason, Microsoft sets the Windows power/performance slider (go.pcworld.com/pwsl) to prolong the battery life at the expense of performance, even when plugged in. We saw that simply tweaking it to full performance can give you a boost for free, so we tested that, too.

We use UL's PCMark 10 benchmark as an overall metric to evaluate day-to-day performance. It's a benchmark suite in miniature, with separate tests to evaluate word processing, spreadsheet use, videoconferencing, photo and video editing, and light gaming. The benchmark then tallies everything up and offers an overall score as a measure of performance.

We generally use a score in the 4,000s to indicate a "good" PC, while a score in the 5,000 range demonstrates excellent performance. As you can see in the chart, the Surface Laptop 4 logs a good score in its default, battery-saving mode. When we crank up the performance slider, the score rises above that golden 5,000 mark.



The Surface Laptop 4's day-to-day performance is largely middle-of-the-road until you rev it up.



It's in CPU-intensive tasks that the Surface Laptop 4 shines.

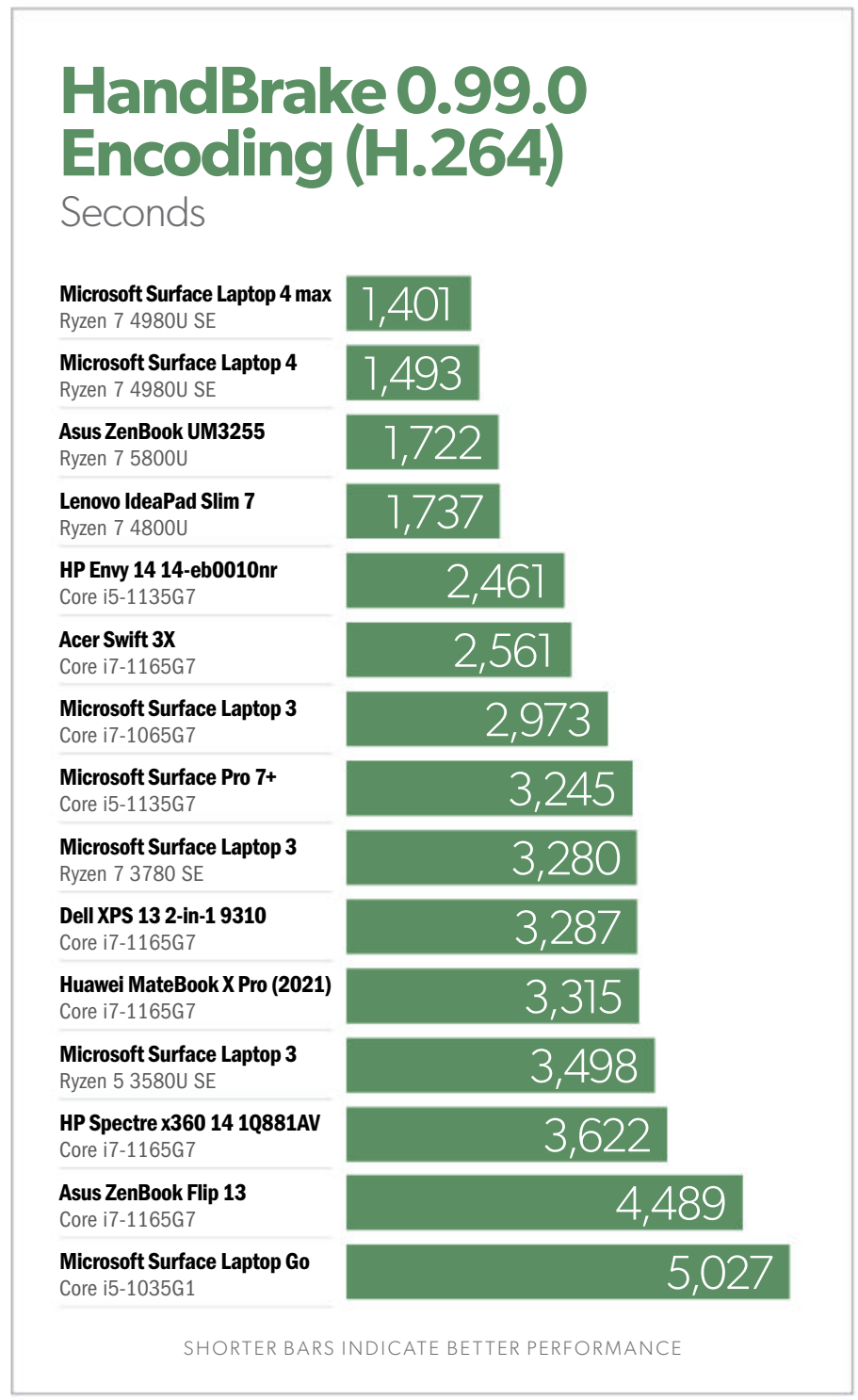
We use Maxon's Cinebench benchmark to test CPU-intensive workloads, especially over the short term. At any performance setting, the Ryzen processor powers through this once-intensive workload in just seconds. This has been Ryzen's strength, especially because the Ryzen 7 4980U contains twice as many cores as the chip inside the Surface Laptop 3.

What we do see, however, is some evidence of throttling under heavy workloads. UL publishes more intensive R20 and R23 benchmarks, and the latter offers the ability to run the benchmark in a loop for 10 minutes. That allows us to gauge whether performance deteriorates as the Laptop heats up. The answer is yes, though not much: A single run of the Cinebench R23 benchmark produced a score of 9,101, versus a score of 8,589 over the prolonged loop—a 5.6 percent decrease.

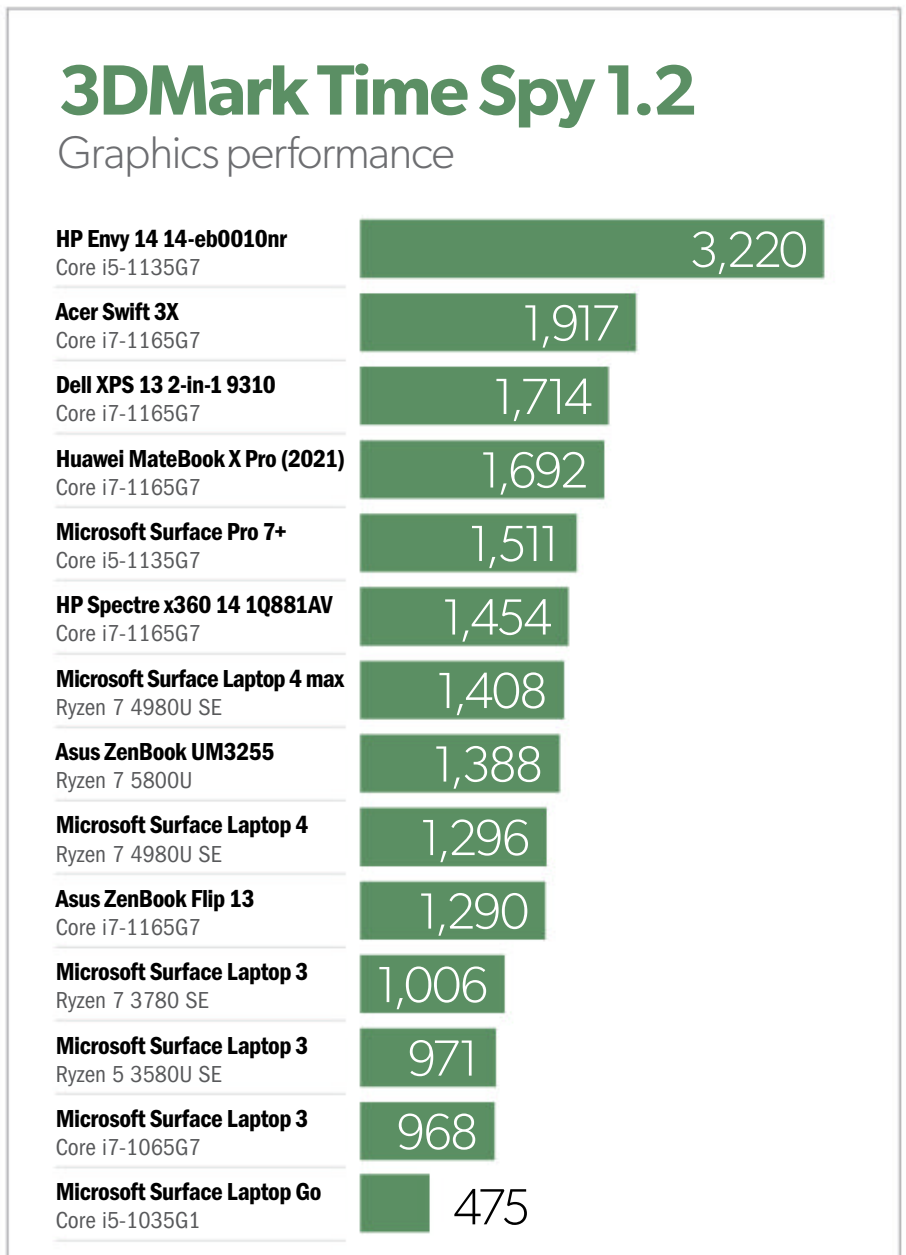
The free HandBrake utility provides another example of prolonged workloads. We use the open-source tool to transcode video from an uncompressed format to something that can be watched and stored on a tablet—a prolonged task. Like Cinebench's R23 loop, it measures both prolonged CPU performance and how well the Laptop 4 cools itself. The Surface Laptop 4 handles this task superbly at both default and performance settings.

To evaluate the Laptop 4's integrated graphics for gaming, we turn to UL's 3DMark and its Time Spy benchmark, which we use for testing gaming laptops, too. Here, we can see that the Surface Laptop 4 shouldn't be used for high-end gaming, as framerates just won't keep up.

We also used UL's built-in stress test to see whether the GPU would maintain its performance during prolonged periods of gaming. If frame rates diverge by more than 3 percent over the course of the test, the laptop fails. Unfortunately, the Surface Laptop 4's frame rate was consistent 96.8 percent of the time, barely failing.



In our HandBrake transcoding test, the Surface Laptop 4 excels.



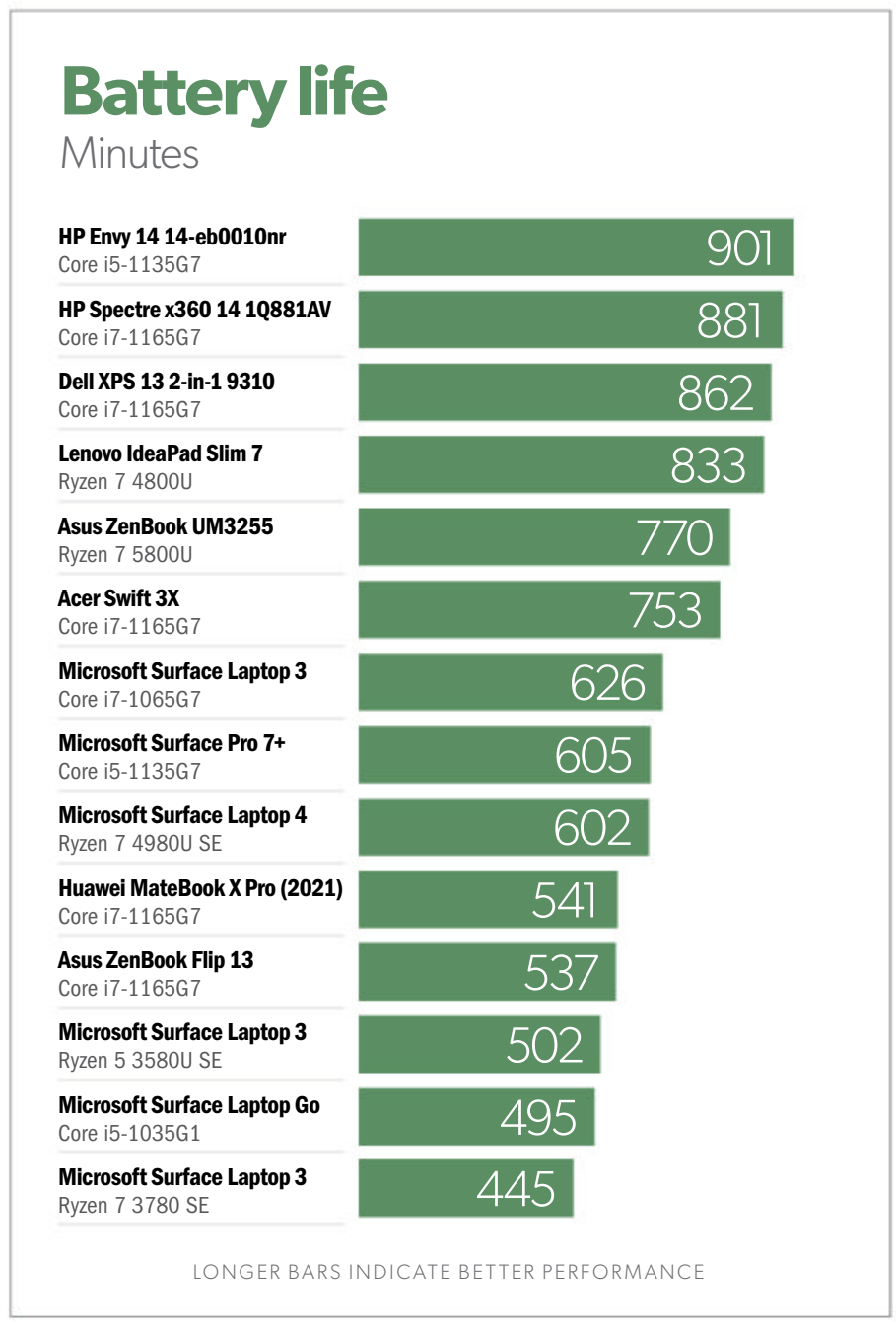
In 3D graphics, it's clearer that Intel's Xe chips offer much stronger competition than in earlier years.

Real-world gaming tests were more favorable. Microsoft's own *Forza Horizon 4* offers a superbly detailed benchmark, allowing you to set target frame rates (30 fps is good, 60 fps is better) and set the resolution and video quality. Repeated testing produced 36 fps at 1080p resolutions at High settings, and a bare 31 fps at Low settings at 2496x1664, the native resolution of the Surface Laptop 4.

Likewise, the third-person battle simulator, Total War:Troy, yielded 48 frames per second at 1900x1200 (essentially 1080p, but adjusted for the 3:2 ratio of the display) at Medium settings using the "Battle" benchmark.

Battery life was the other major source of potential improvement. Although the version of the Surface Laptop 3 that was powered by Intel's 10th-gen Tiger Lake chips performed well, the Ryzen versions disappointed.

We never expected the Surface Laptop 4 to meet Microsoft's claims, because the battery-life estimates (17.5 hours!) were predicated on a very dim 150 nits of screen



The Surface Laptop 4 redeems the battery-life shortcomings of its predecessor, though you'll still find many other laptops that do better.

You can pick and choose various resolution and quality levels, but we think running Forza at 1920x1200 at Medium settings offered both satisfactory frame rates and image quality. (Though the target is 60 fps, 30 fps works well in this racing game.) Notice, though, that *Forza* concludes the Surface Laptop 4 is limited by its integrated GPU.

brightness. We prefer using 250 nits, which the Surface Laptop 4 can't reach on battery power. An average battery life of just over 10 hours doesn't come close to Microsoft's lofty claims, but it makes for a solid all-day machine.

BOTTOM LINE

Microsoft's Surface Laptop 4 (Ryzen 7) is undoubtedly a solid offering compared to other laptops in this generation. Its design is as good as ever, and while its performance is mixed, it often finishes at the top of the heap. Battery life has improved, even if you'll find that Microsoft has sneakily lowered the screen brightness when running on battery power. It remains premium-priced, but you get a lot for the money.

If you own a Surface Laptop of any stripe and you were considering an upgrade, we'd certainly recommend this machine. The Surface Laptop 4 has improved in the critical areas of performance and battery life, especially given that it is a direct Ryzen-to-Ryzen upgrade.

Is it the *best* Surface Laptop 4? We're waiting and hoping to see what Intel's Tiger Lake model has to offer, as we did with the Surface Laptop 3. This time, however, we're expecting a much more even battle.

Microsoft Surface Laptop 4

★★★★☆

PROS

- Significantly improved battery life.
- Enormous performance improvement from prior generation.
- High-resolution display.
- Good keyboard.

CONS

- Surface Connector is used in place of Thunderbolt.
- A bit pricey.

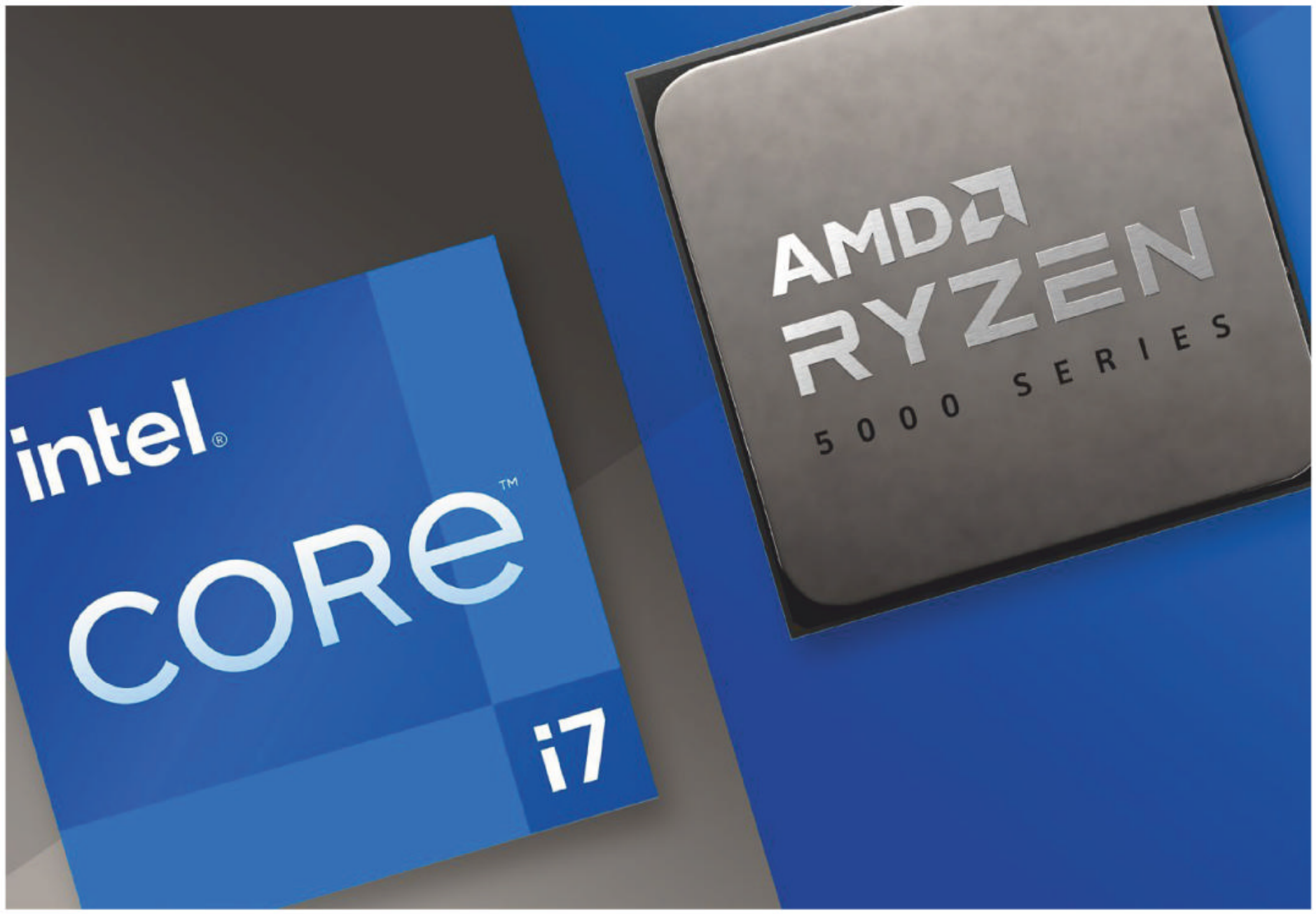
BOTTOM LINE

Microsoft's Surface Laptop 4 marks a dramatic improvement for this clamshell notebook over the prior generation, though its Ryzen processor may be overshadowed by the competing Tiger Lake model.

$1,500

Tested: Is Ryzen 5000 battery performance really that bad?

Why it takes a hit, and why it may not be a big deal. **BY GORDON MAH UNG**



Is the performance of AMD Ryzen mobile on battery really that bad? If you're asking that question, you've doubtless heard Intel's claims that Ryzen 4000 CPU performance tanked running on battery (go.pcworld.com/tank). Plugged-in performance was dandy, but in tests of multiple Ryzen 4000U-based laptops, performance dropped hugely on battery, depending on the task.

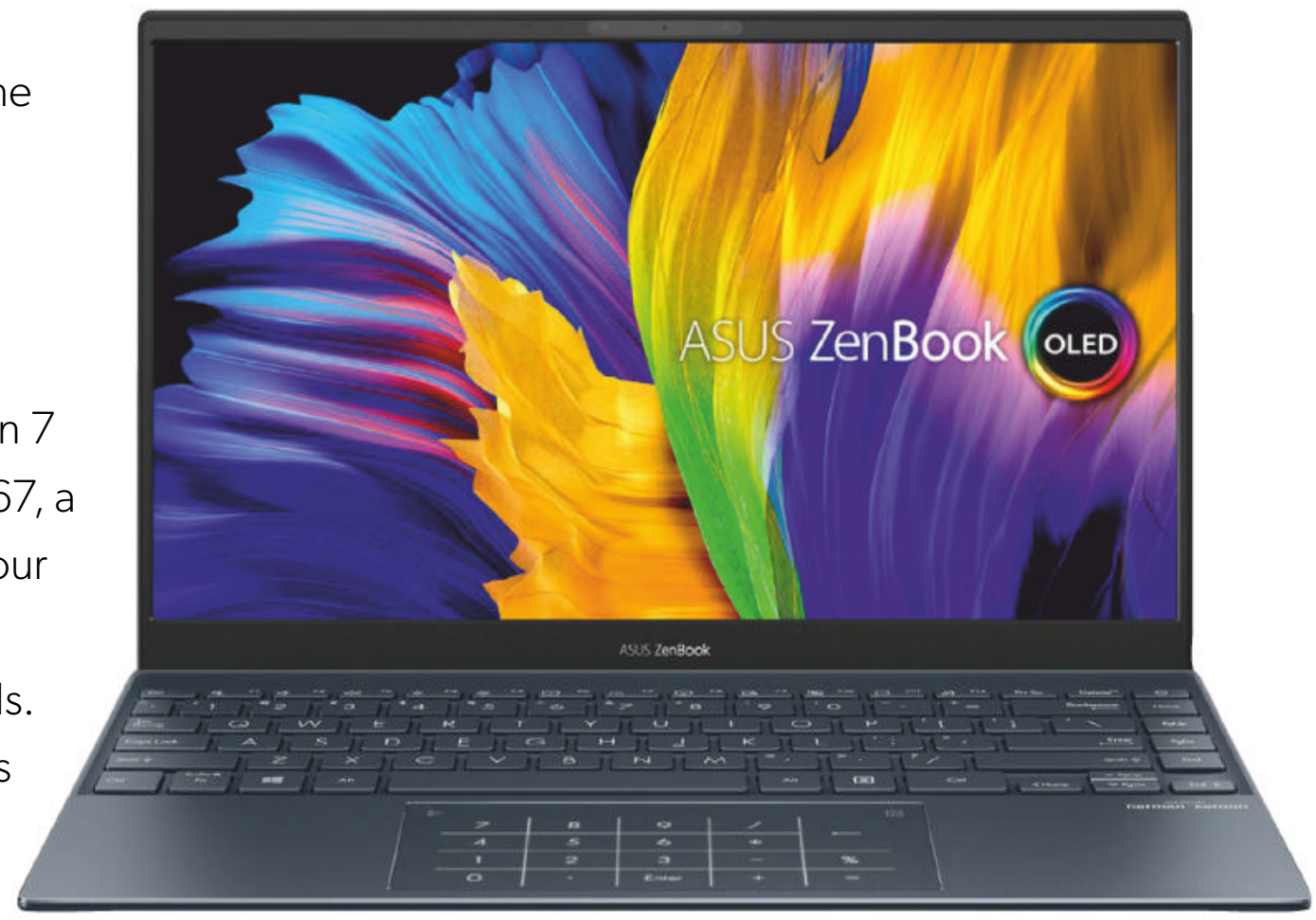
While some reviewers checked AC and DC performance and found some nuggets of truth to Intel's claims, the issue has mostly lain dormant for the last six months. Now that Ryzen 5000 is out, we decided to circle back and see if the claims still held. As you'll see in our tests, what's "good" or "bad" depends on whether you care more about performance or battery life.

IMAGE: ROB SCHULTZ

HOW WE TESTED

For our testing we used the same two laptops from our Ryzen 7 5800U review (go.pcworld.com/580u):

- Asus ZenBook UM325. It features AMD's eight-core Ryzen 7 5800U, 16GB of LPDDR4X/4267, a PCIe 3.0 1TB SSD, a 65-watt-hour battery, and a 13.3-inch 1080p OLED, and it weighs 2.6 pounds.
- MSI Prestige 14. It features Intel's four-core 11th-gen Core i7-1185G7, 16GB of LPDDR4X/4267, a PCIe 4.0 512GB SSD, a 52-watt-hour battery, and a 14-inch 1080p IPS-level screen, and it weighs 2.7 pounds.



The Asus ZenBook UM325 features AMD's new Ryzen 7 5800U.

It's important to note that there's almost no such thing as an apples-to-apples comparison with laptops. Intel and AMD give laptop makers the CPUs, but everything else is specific to the vendor's design for that system, from the display type and size, to the cooling design and the keyboard and the battery. Think of laptops instead as pairings of a specific design to a specific CPU—in this case, Asus ZenBook with Ryzen and MSI Prestige 14 with Core i7. These two laptops were among the first out of the

MSI's Prestige 14 EVO features Intel's 11th-gen Core i7-1185G7.

gate with their respective CPUs, so they are representative of what to expect.

Both laptops were running Windows 10 20H2 (Build 1904.867) and the latest drivers available. Windows 10 offers four different power performance states that you can select when using a laptop. According to Microsoft documentation, they are:

Best Performance: Favors performance over power and is targeted at users who want to trade off power for performance and responsiveness. Available on both AC (plug-in electricity) and DC (battery).

Better Performance: Default slider mode that slightly favors performance over battery life and is appropriate for users who want to trade off power for better performance of their apps. Available on both AC and DC.

Better Battery: Delivers longer battery life than the default settings on previous versions of Windows. Available on both AC and DC. In some cases, users will see this mode labeled Recommended, rather than Better Battery, in their slider UI.

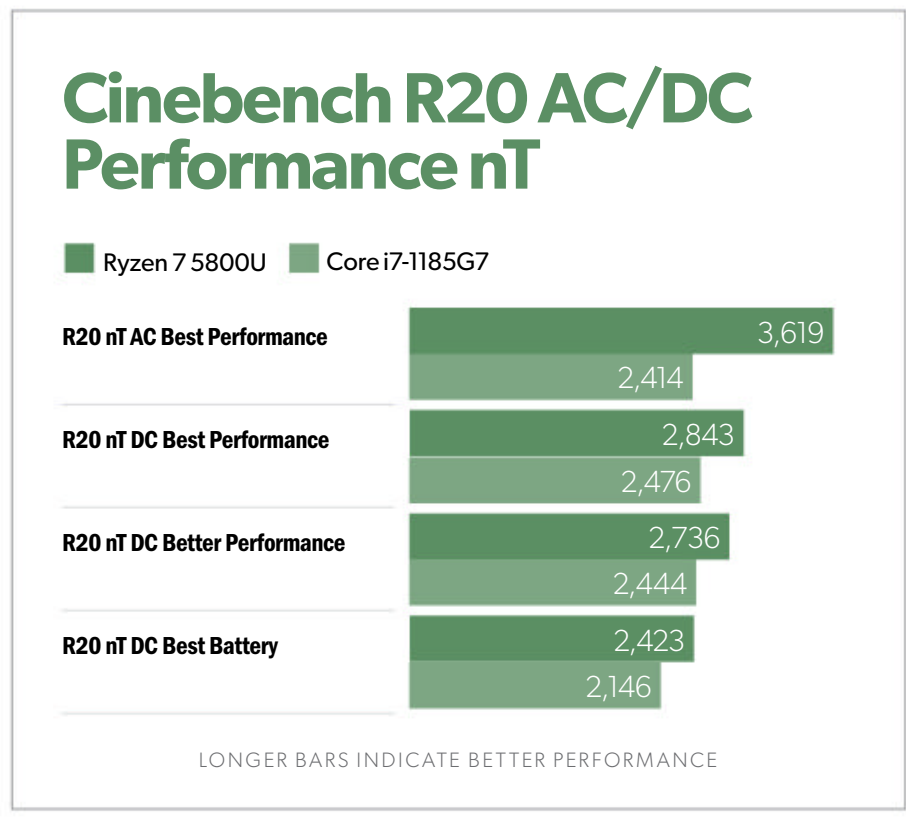
Battery Saver: Helps conserve power and prolong battery life when the system is not connected to a power source. When Battery Saver is on, some Windows features are disabled or throttled, or behave differently. Screen brightness is also reduced. Battery Saver is only available on DC.

For our testing, we used only the first three modes, because it's understood that Battery Saver mode will necessarily involve a performance degradation. The ZenBook's default unplugged mode is Better Battery, while the Prestige 14's default unplugged mode is Better Performance.

CINEBENCH AC/DC TESTING

We'll kick this off where we typically begin: Maxon's Cinebench R20 3D rendering benchmark. It's a test built on the company's Cinema4D engine, which is integrated into Adobe's Premiere and After Effects, and is also sold standalone. Like all 3D-modeling applications, it favors more CPU cores and threads.

On this and all charts to follow, we show the AMD chip in dark green and the Intel chip in light green.

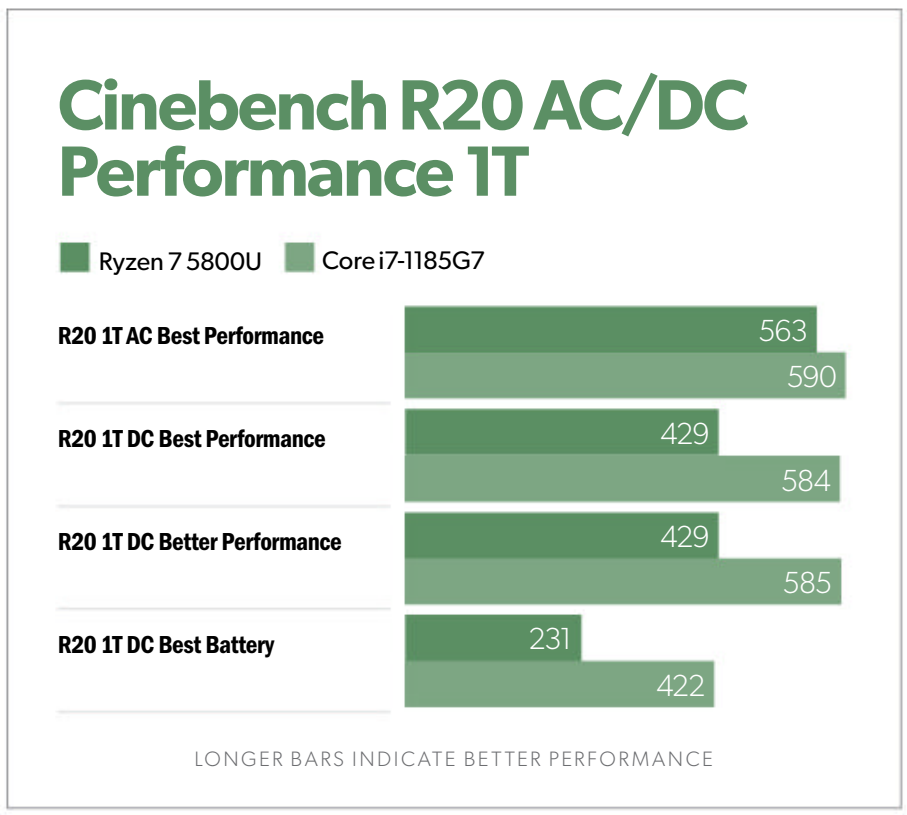


In Cinebench multithreaded performance, the Asus/Ryzen startso ff strong on AC, but lots most of its advantage on DC.

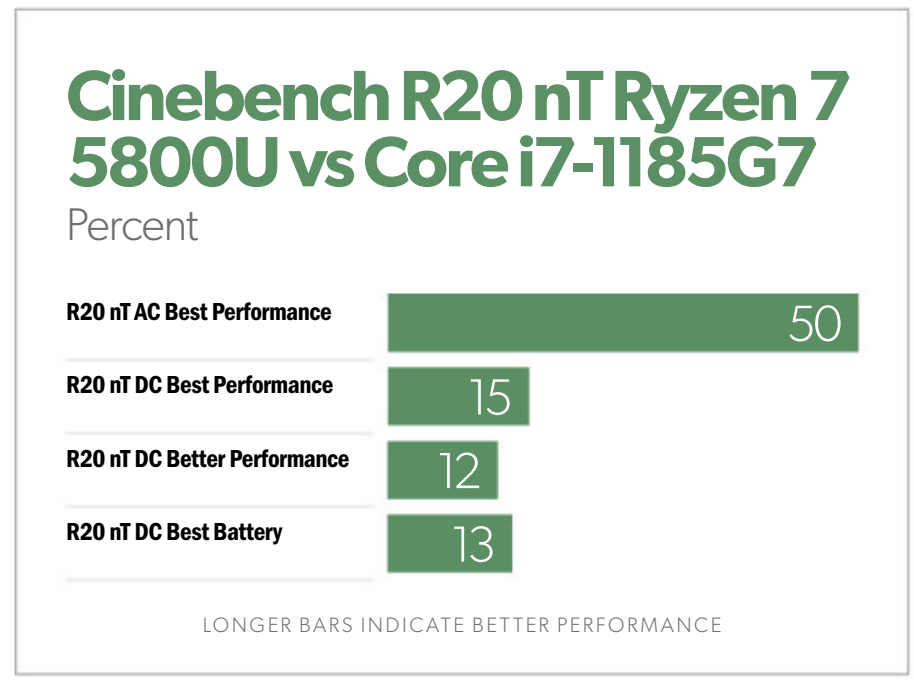
In the first chart, for Cinebench multithreaded performance, the top pair of bars shows the stomping you've come to expect when pitting an eight-core CPU (AMD's Ryzen) against a four-core CPU (Intel's 11th-gen Core)—when running on AC, anyway. Once we switch to DC battery, for all other results shown below, you can see the drastic falloff in performance for the Ryzen-based Asus. The four-core Intel chip gets uncomfortably close. However, you don't see steeper declines as you move through the lower performance/power stages.

Using Cinebench R20 set to a single thread, we can see that both laptop/CPU combos exhibit very different behaviors. The Core i7-1185G7 in the MSI basically doesn't move going from AC to DC in Best Performance or Better Performance. Meanwhile, the Ryzen 7 5800U in the Ryzen is really chugging in the Better Battery setting in single-threaded tasks.

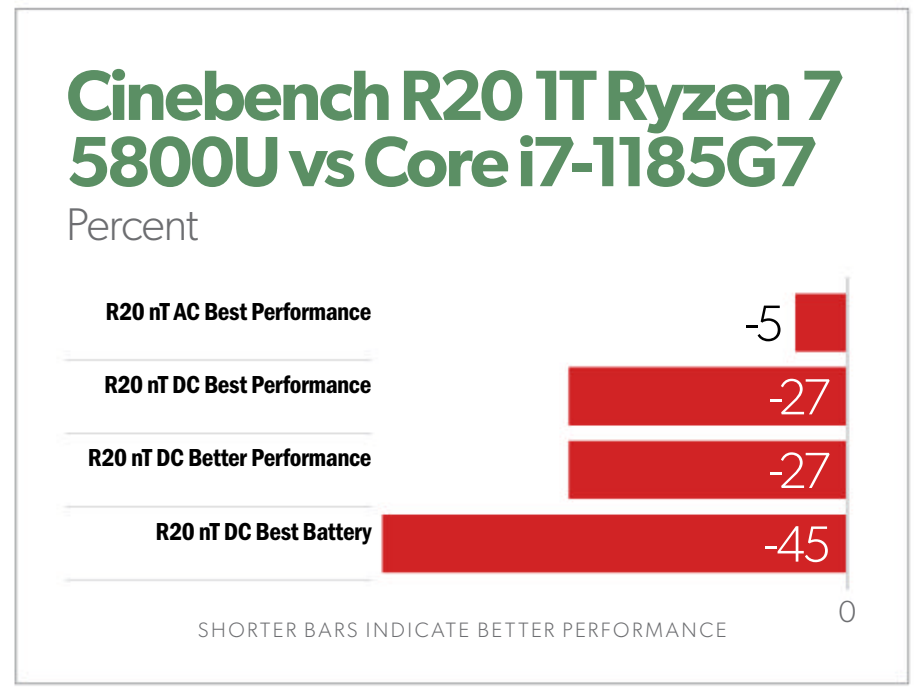
Let's take those Cinebench results and look at how both laptops compare as a percentage. In multicore mode, you can see the Ryzen's advantage range from a whopping 50 percent to narrower leads running on DC battery in the other power settings.



In Cinebench single-threaded, the MSI/Intel pairing prevails, while Ryzen loses more ground as you move through the different power settings.



This is how much performance the Ryzen 7 5800U sheds versus an Intel Core i7-1185G7 plugged in or running on batteries, using three different Windows Power Performance Slider settings.



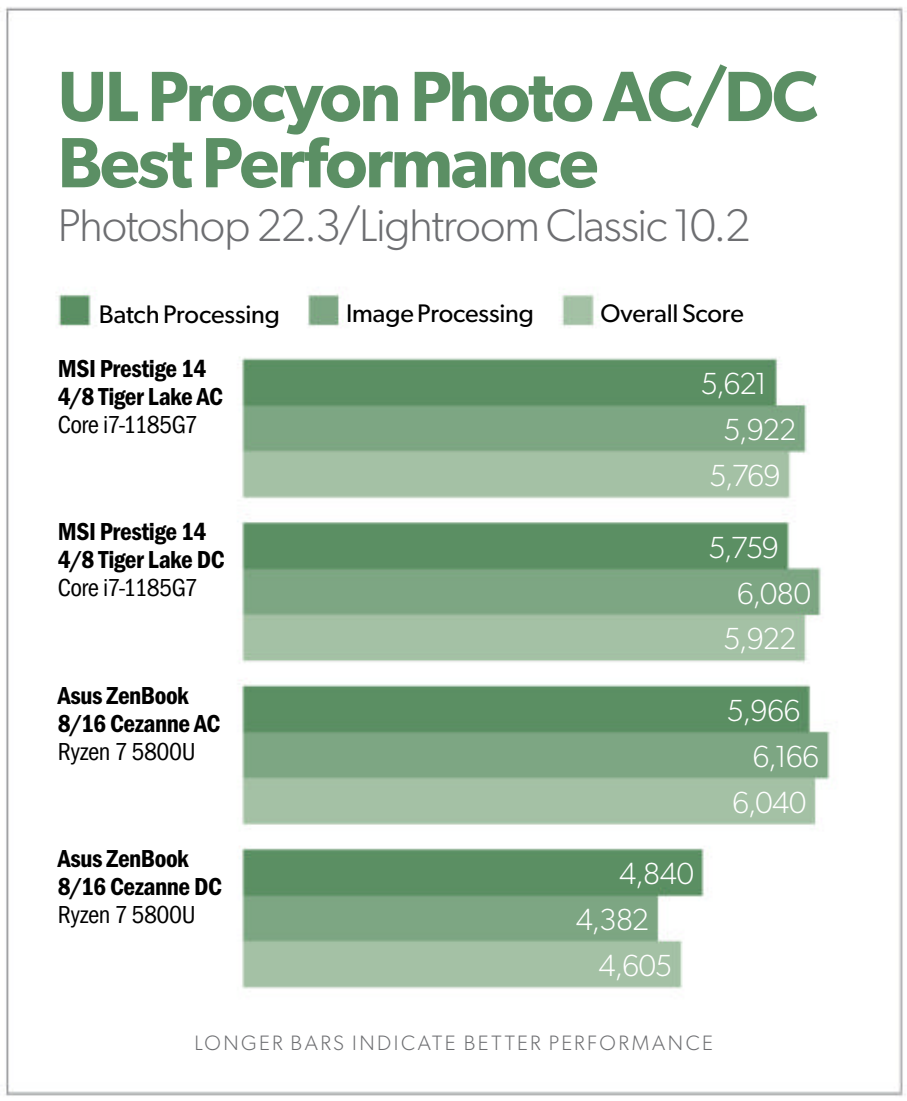
The AMD Ryzen 7 5800U laptop is always behind the Core i7-1185G7 laptop and drops further depending on the Windows power slider setting.

In single-threaded performance we see an inverted chart. That's because while the Prestige 14/Core i7 was actually competitive with the ZenBook/Ryzen 7 on AC, we're looking at a 27 percent to 45 percent lead for Intel on the DC battery settings. That's a major difference, and we'll likely see this manifest itself later on.

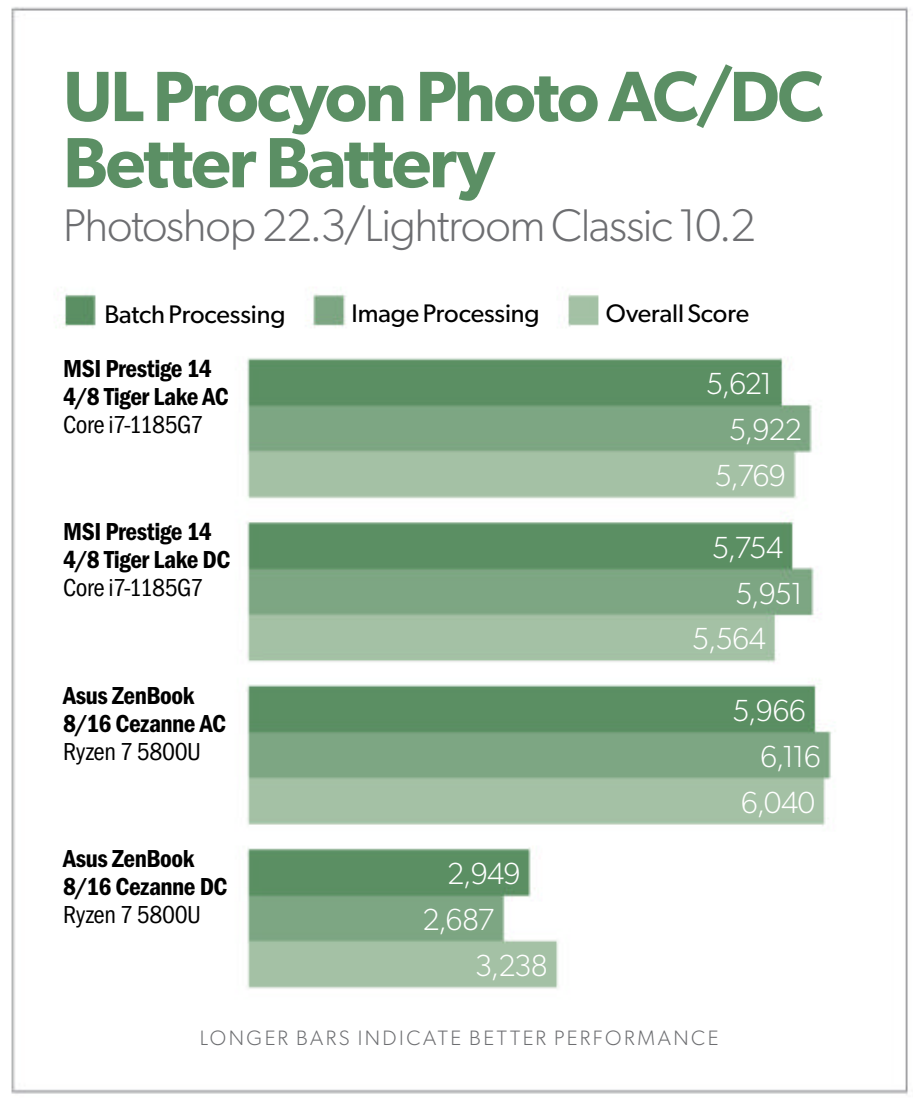
RYZEN VERSUS CORE i7: PHOTOSHOP AND LIGHTROOM AC/DC

We know that very few people perform 3D modeling or rendering on a 13-inch ultraportable laptop, so we use Adobe Photoshop 22.3 and Lightroom Classic 10 with UL's Procyon Photo test as something that's popular but not exactly lightweight and still CPU and GPU intensive. Procyon runs both Adobe apps through a set of scripted tasks while measuring the response.

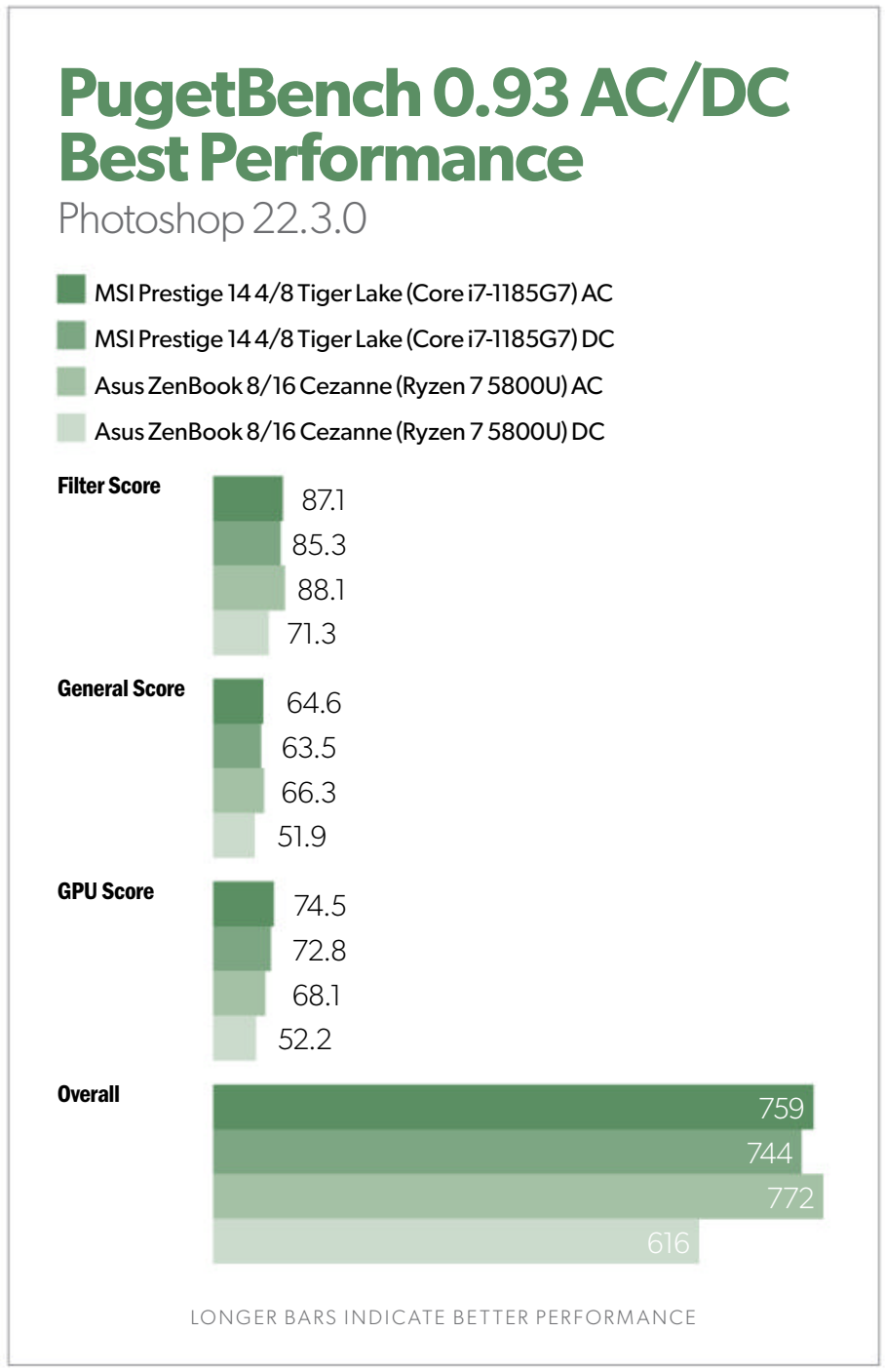
The good news for Ryzen in the Asus ZenBook is that it's outpacing Intel's best U-class CPU in the MSI laptop. The nagging problem, though, is that once you're on battery, even on the laptop's Best Performance setting, the ZenBook and Ryzen 7 are giving up 24 percent in performance in Photoshop and Lightroom against the Intel/MSI pair.



In the Procyon benchmark, Intel/MSI holds steady in the Best Performance setting, while Ryzen/Asus falters when on battery.



In the same Procyon benchmark but on the Better Battery setting, the Ryzen/Asus laptop falls even further behind when on DC battery.



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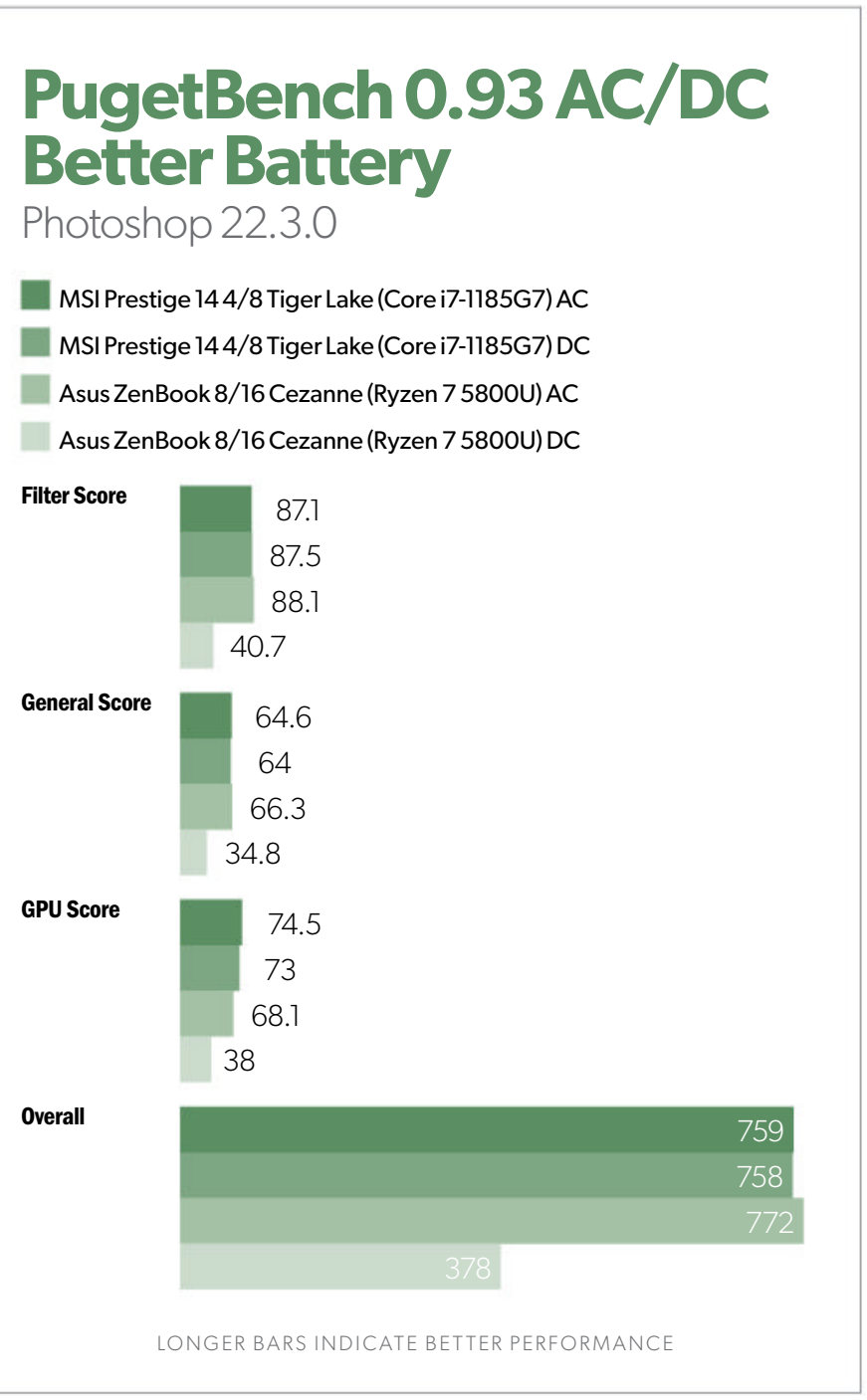


The Asus/Ryzen laptop falls more precipitously in ProCyon in Better Battery mode.

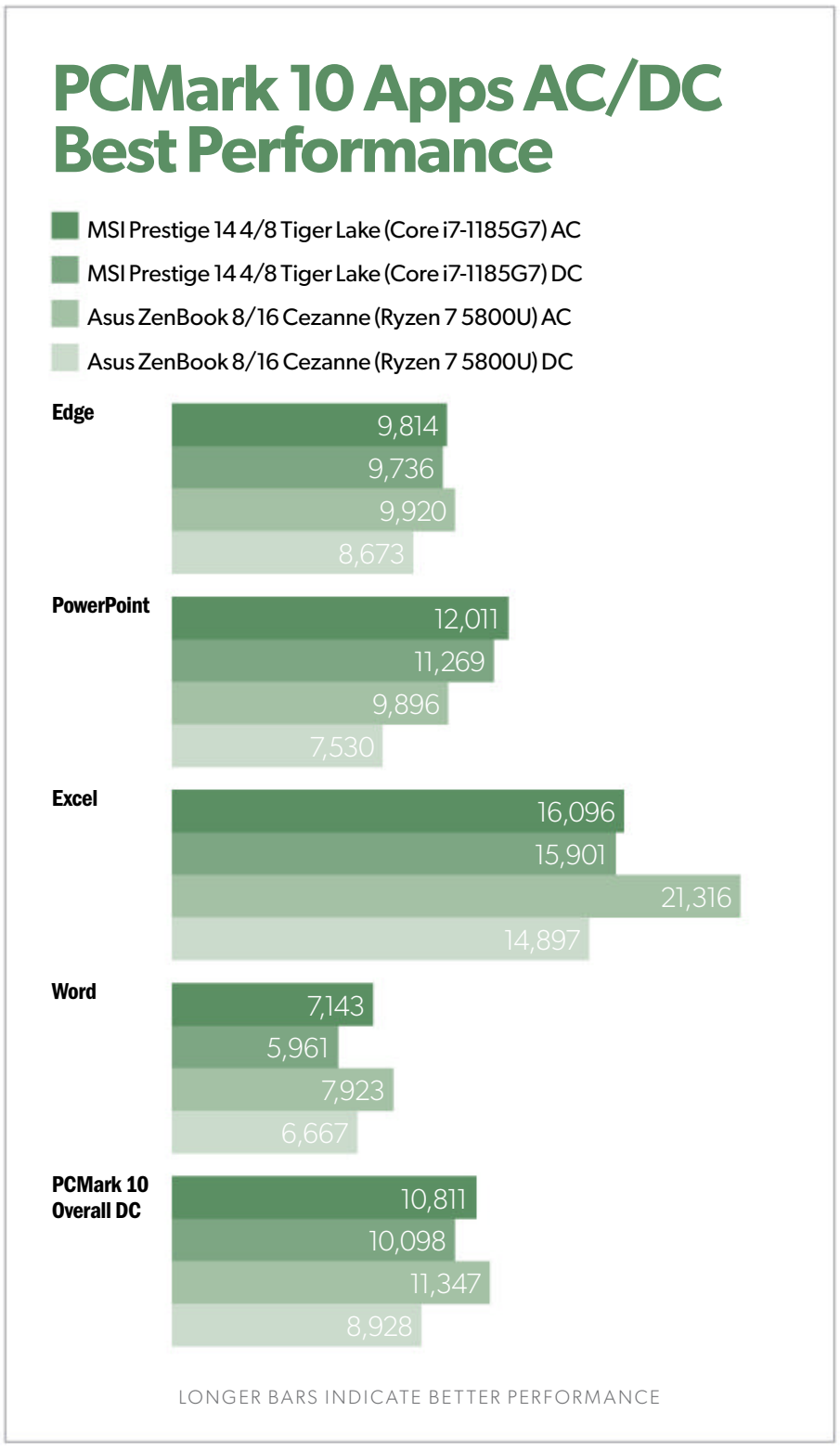
The performance lag gets even harsher for the ZenBook/Ryzen 7 running on the Better Battery setting. It's basically cut in half versus the MSI Prestige 14/Core i7.

With such a powerful suite as Photoshop, what you do can influence performance. We get a second opinion from workstation builder Puget Systems and its PugetBench 0.93 (go.pcworld.com/p093) test. We again see the Prestige 14 and Core i7 hold steady in performance between AC and DC using the Best Performance setting. The ZenBook and Ryzen 7 combo again sees a drop in performance from AC to DC.

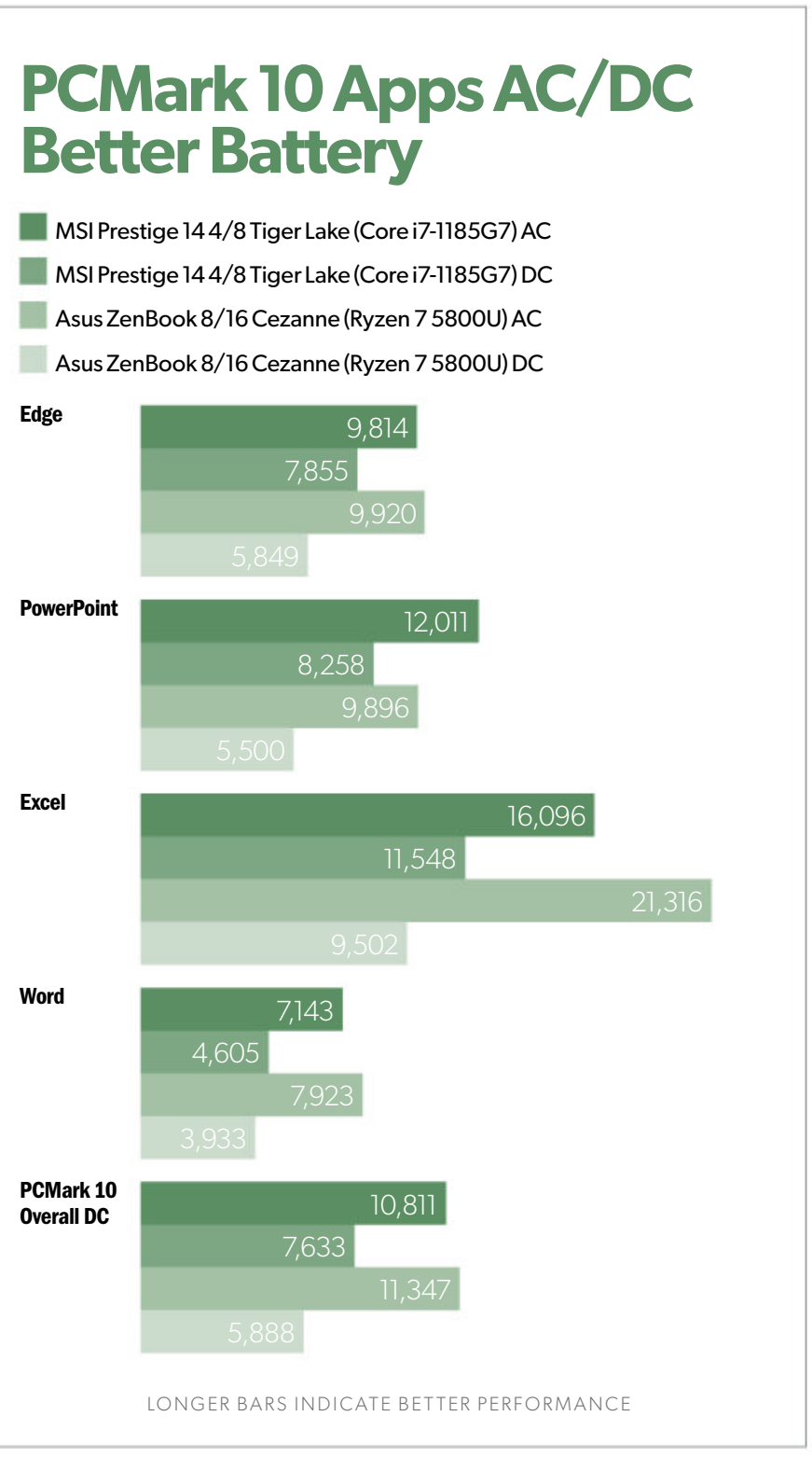
As with Procyon, PugetBench for Photoshop again sees a pretty drastic performance drop on Better Battery.

RYZEN VERSUS CORE i7: OFFICE AC/DC

Let's be honest—most people wish they could be editing photos from a monthlong trip to



The Asus/Ryzen laptop's Excel performance takes a drastic hit in performance on battery.



In Better Battery mode, both laptops take a drop, but the Asus/Ryzen falls further.

Bali on their 13-inch ultraportable, but they're more likely massaging Word and Excel files, or making a PowerPoint presentation using pictures from their boss's trip to Bali.

To look at Office performance under AC or DC conditions, we use UL's PCMark 10 Application, which, like Procyon, uses the full version of Office 365 to test Word, Excel, PowerPoint, and Edge performance.

The big win for the ZenBook/Ryzen has been its performance under AC, where, despite the very lightweight nature of Office, it actually beats the Prestige 14/Core i7 pairing.

Unplug the ZenBook and Prestige 14, and we see the Intel Core i7 jump to the front. We'd argue you'd hardly feel it in most tasks, but it is a bit eyebrow-raising to see the performance of the Ryzen 7 in Excel sharply

drop off by 30 percent. Again, we're using the Best Performance setting.

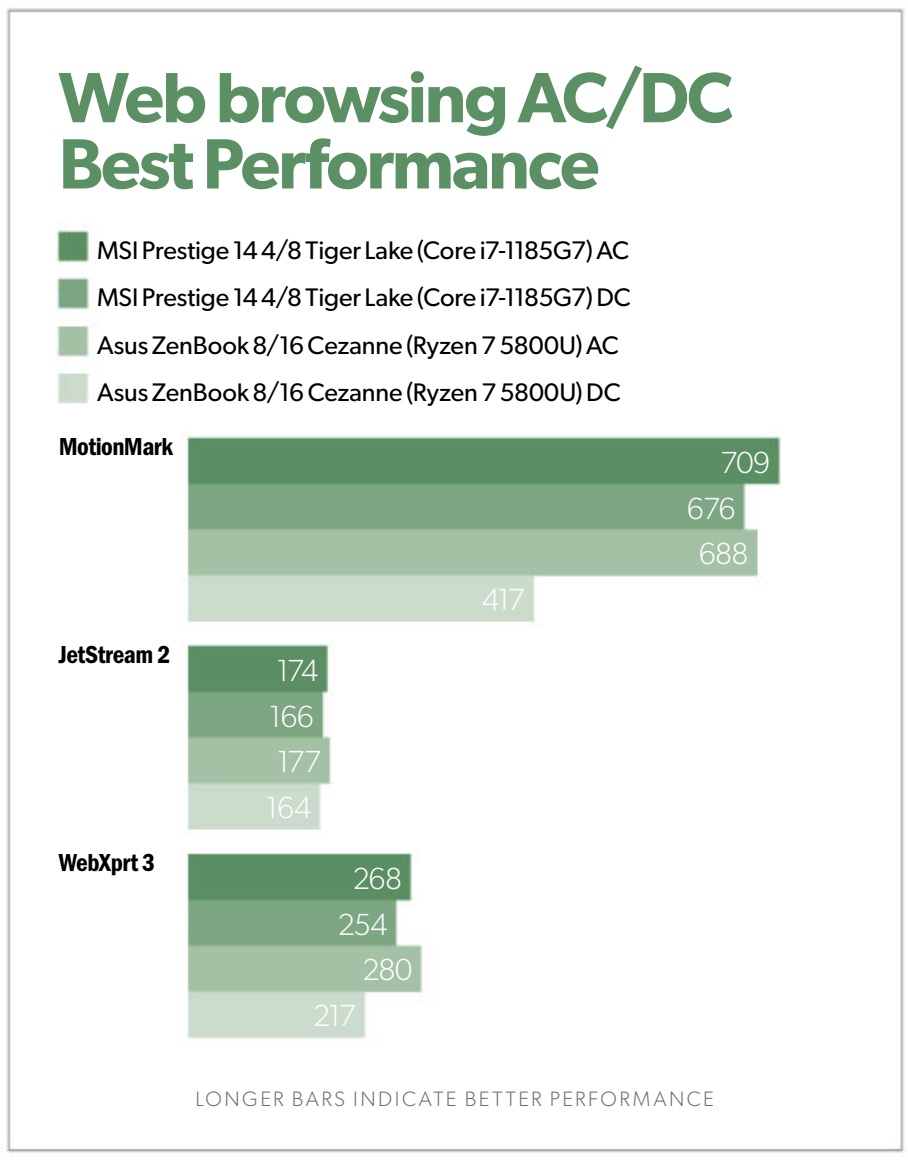
Moving the Windows 10 slider to Better Battery, we now see both laptops' results slack off quite a bit. The Prestige 14/Core i7 remains in front of the ZenBook/Ryzen 7, which again gives up almost half.

RYZEN 7 VERSUS CORE i7: BROWSING AC/DC

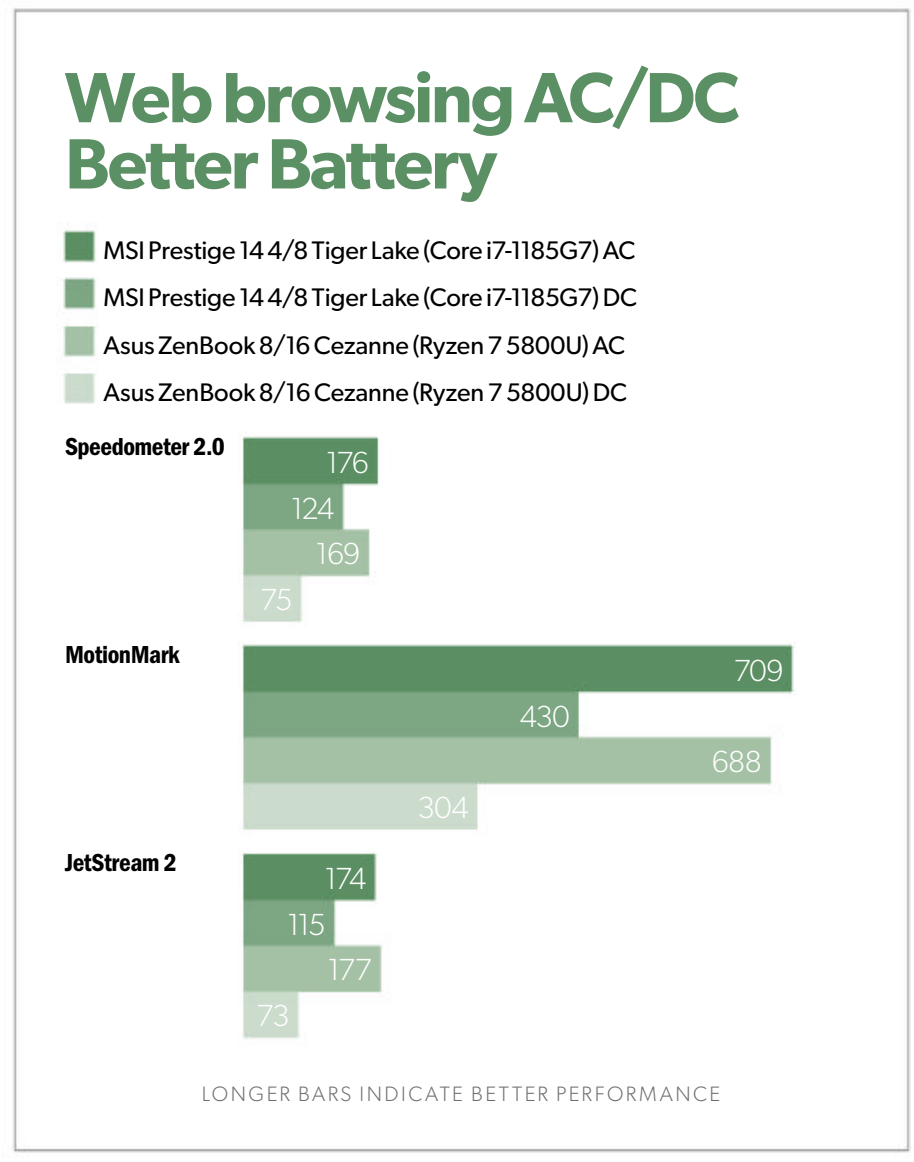
We'll step back to an even lighter-duty task, but one that many people do on a tiny laptop unplugged: browse the web. To gauge performance, we ran both laptops through Principled Technologies' WebXPRT 3, as well as JetStream 2, MotionMark 1.1, and Speedometer 2.0.

In these tests the darker blue represents Intel on AC, while the darker red is for AMD on AC. The lighter colors represent DC performance with the Windows 10 slider set to Best Performance. We used the same version of Google Chrome 90 for both laptops.

The big win here for AMD is on AC in the ZenBook, which performs ahead of Intel's best low-power CPU in WebXPRT 3. The other tests are mostly a back-and-forth—on AC. Unplug those laptops, though, and you get a solid lead across the board for the Intel/MSI pairing.



In browser benchmarks on Best Performance, Ryzen is competitive except on battery.



Move down a notch to Better Battery in Windows, and Ryzen falls further off the mark.

Set the laptop to its Better Battery test, and both laptops fall off in performance even more—but the Ryzen 7 in the ZenBook falls off furthest. WebXPRT 3, for example, shows about a 30 percent drop for the Core i7, while the Ryzen sees closer to a 50 percent performance drop.

WHAT ABOUT POWER CONSUMPTION?

It's impossible to separate the laptop from the CPU when talking about battery life. What screen is used, how much memory, how good the motherboard's power modules are, driver optimization, and battery capacity all contribute to the laptop's endurance.

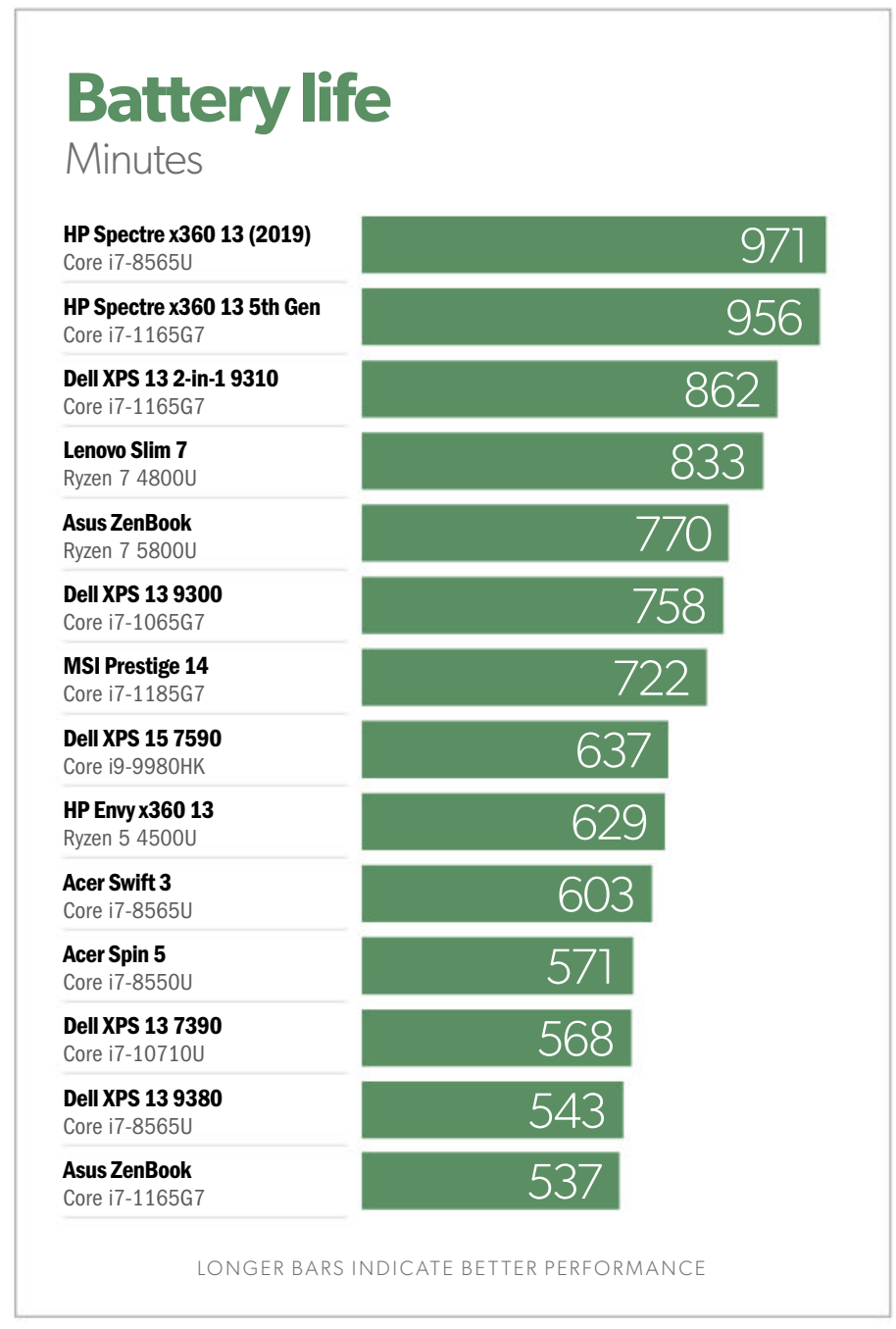
Our official test for battery rundown loops a 4K video, with the laptop set to airplane mode and its screen set to 250 nits to 260 nits of brightness. We also set the volume to medium and plug in earbuds.

As you can see in the chart right, the OLED Asus ZenBook and its honking-big 65-watt-hour battery does pretty well, exceeding 12 hours of run time. The MSI Prestige 14 also just breaks 12 hours with its smaller 47-watt-hour battery. However, this is a pretty easy test, and your mileage will vary depending on what you actually do.

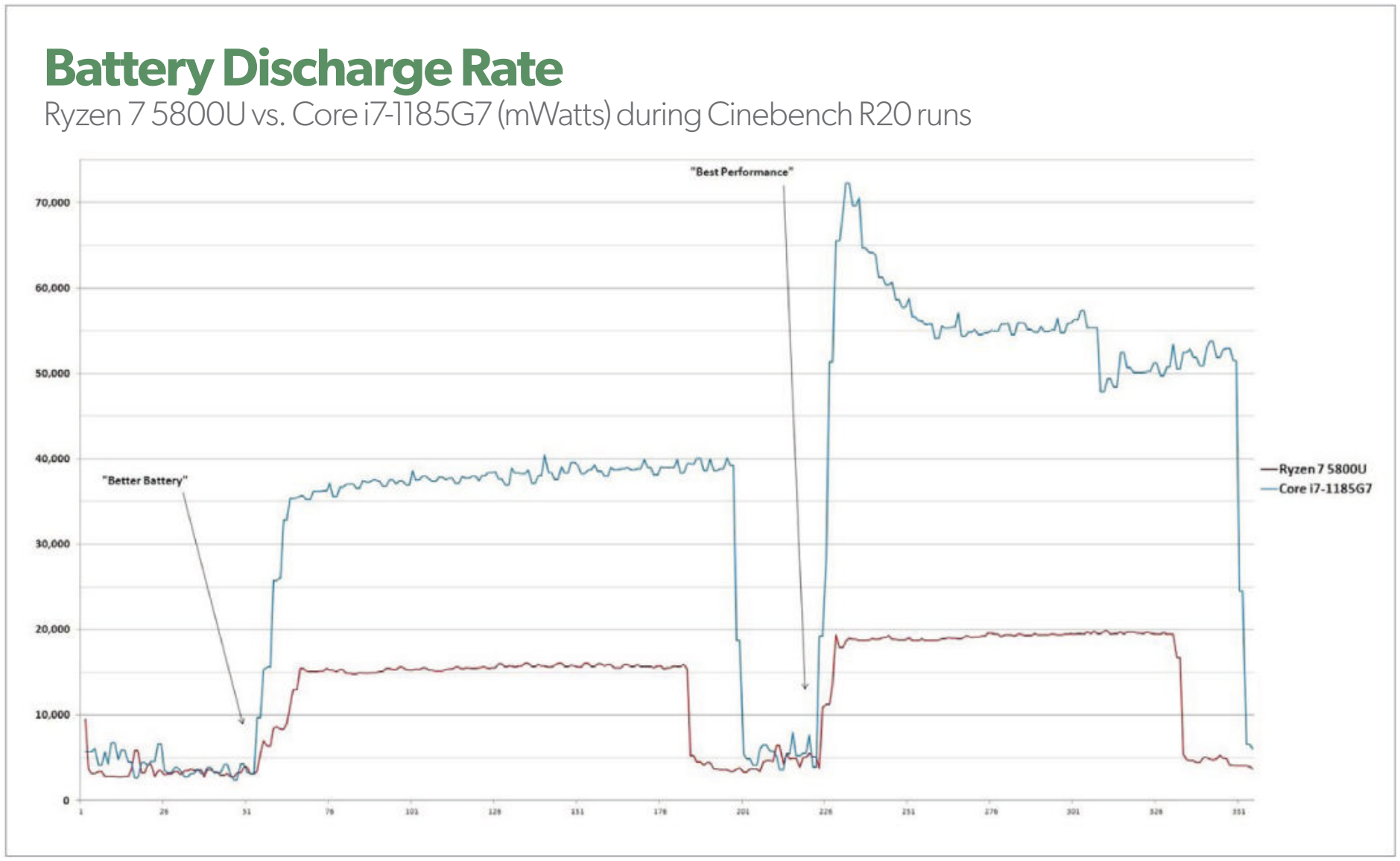
So we took it a step further and looked at how much power is consumed in the laptops during many of the tests. Reported wattage doesn't always translate to direct battery life, so instead we tracked the battery discharge rate of the laptops while running some of the tests again, unplugged. Every watt used denotes a drain on your battery.

Below you can see both laptops running Cinebench R20. The first run is using the Better Battery setting in Windows 10, while the second is using the Best Performance setting. The result is in milliwatts.

You can see trhat part of the magic of the Core i7 in the MSI on battery is due simply to using more power—sometimes a lot more. In the first Cinebench R20 run, it's almost a 40-watt load, spiking up to a massive 70



Neither laptop has anything to be ashamed of in terms of battery life.



You can see the Core i7-1185G7's tendency to run full-tilt in the MSI Prestige 14 puts a much heavier load on the battery than does the Ryzen 7 5800U in the ASUS ZenBook.

watts in Best Performance mode before completing the run mostly in the 55-watt to 50-watt range.

The Ryzen 7 in the ZenBook is far easier on the gas pedal, with the battery discharge rate at roughly 15 watts in Best Battery and about 20 watts in Best Performance.

As you can guess, putting that heavy a load on a battery means you'll run it down far faster. In our testing, the dent in the MSI Prestige 14's battery was visibly different after the Cinebench runs, unlike with the Asus. To be fair, the Asus's battery is 38 percent larger, so any reduction in capacity appears larger on the MSI. But more power used means less run time, no matter how you cut it.

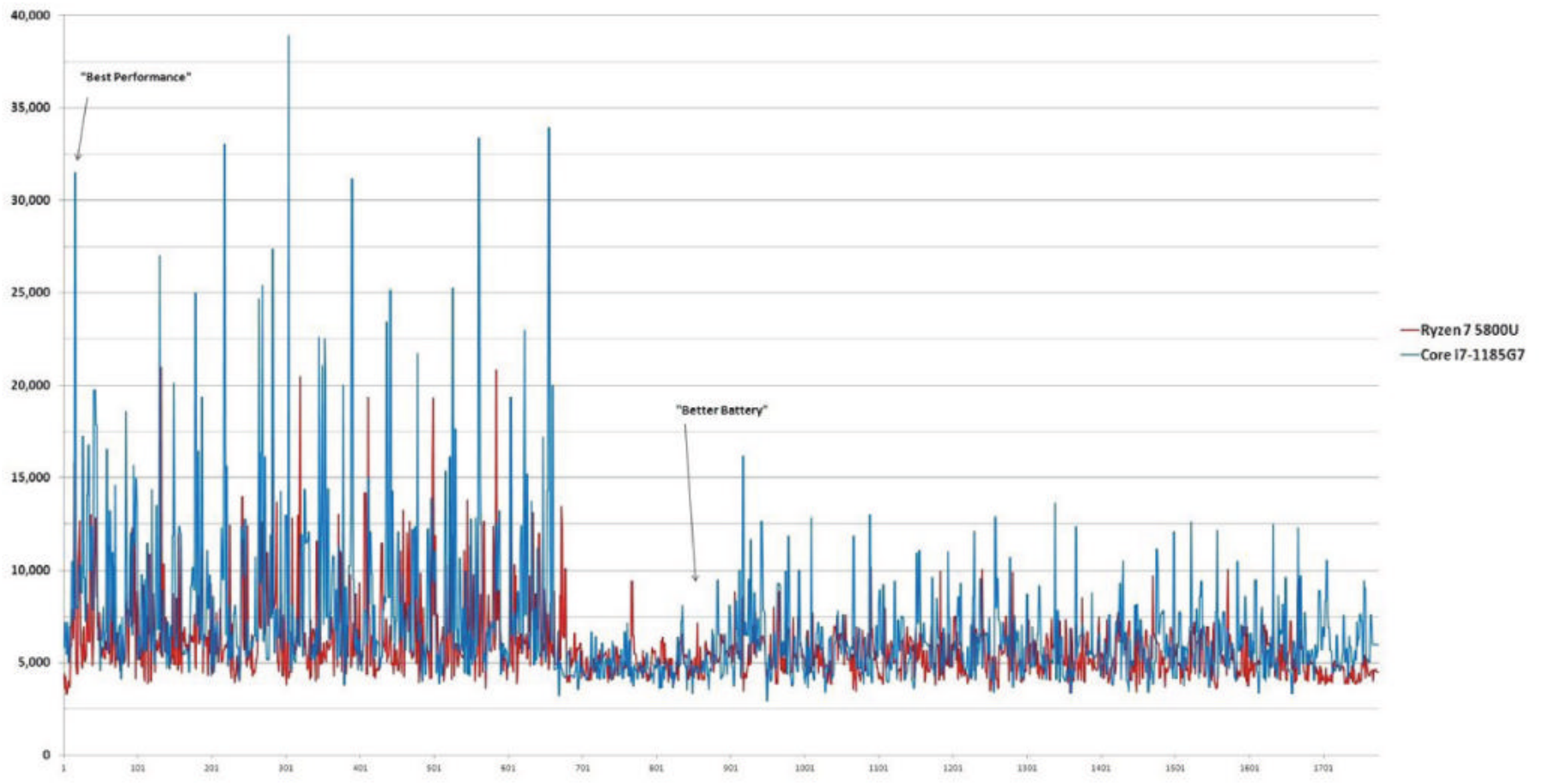
An all-core load is still very unrepresentative of what most people do, so we also looked at the discharge rate of both laptops doing everyday practical browsing.

Below you can see WebXPRT 3 running on Google Chrome 90 in Best Performance mode, and then Better Battery, on both laptops. The Intel-based laptop tended to have occasional high-boost clocks, which led to short spikes in battery discharge rates.

After these runs, the reduction in the Prestige 14's battery wasn't as noticeable. For those who mostly do short, light boosty

Battery Discharge Rate

Ryzen 7 5800U versus Core i7-1185G7 (mWatts) during WebXPRT 3 runs



The MSI Prestige 14 and Core i7-1185G7 will hit the battery harder than the Asus ZenBook and Ryzen 7 5800U, but in lighter tasks the difference isn't as drastic.

work, any disparity between Intel and AMD rival CPUs won't be as apparent.

It's not like Intel is trying to hide this information on power consumption. Look at the slide shown opposite from Intel's presentation when it originally launched its Tiger Lake chip last year.

In its presentation, Intel basically was already saying that Ryzen's performance is heavily nerfed just based on the wattage the chip consumes versus the wattage the Core i7 consumes. Of course, the company doesn't show you that more wattage used also means you have less available battery life.

WHO'S RIGHT—INTEL OR RYZEN?

If you're looking for undisputed winners and losers, you're not going to find them in this story. Intel's 11th-gen CPUs and AMD's Ryzen 5000 mobile CPUs demonstrate different philosophies on how to build the best consumer experience.

With Tiger Lake, Intel seems to buy into the concept of increasing performance perception by giving you a very short boost to keep the laptop as responsive as possible—even when on battery. You launch Word or Chrome and start browsing, and the laptop will spike up to very high clock

18+

WHAT IS AVAXHOME?

AVAXHOME-

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Protect your downloadings from Big brother
Safer, than torrent-trackers

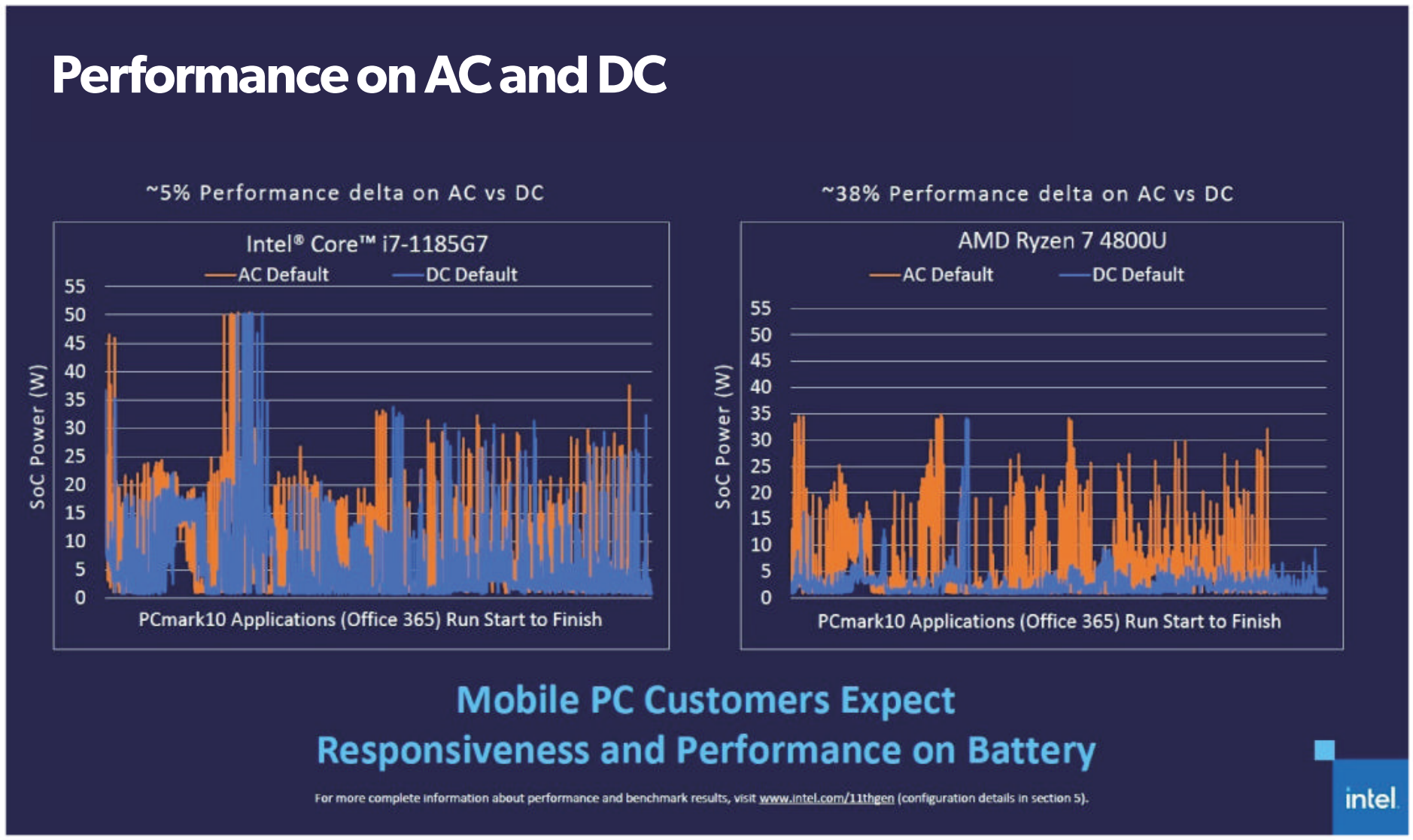
18 years of seamless operation and our users' satisfaction

All languages
Brand new content
One site

AVXLIVE.ICU

AvaxHome - Your End Place

We have everything for all of your needs. Just open https://avxlive.icu



speeds and very high and short-duration wattage use.

The weakness in Intel's approach, obviously, is the sacrifice of battery life to get that responsiveness. If you want to mash the pedal all the time and eat up your battery at the highest performance, go right ahead.

Ryzen, and the laptops we've seen so far that have it, favor a far more conservative approach—sacrificing performance to get as much run time as possible. That high boost response is great—but not if it means you've eaten up your battery to get there.

The weakness in AMD's approach, at least implemented here, is the dampening of performance all the time to save the battery. In our testing, we never got the same performance out of the ZenBook and Ryzen 7 on battery as we could when plugged in. That's great—if everyone's goal is extending the battery life. But some people truly want or need to crank it up, which runs counter to that slow-and-steady scenario.

The short answer to the question we started with is: Yes, Ryzen, even in the newest Ryzen 7 5800U, suffers—sometimes greatly—when running on battery in the Asus ZenBook. And yes, to be fair, we have to say the Core i7-1185G7 in the MSI Prestige 14 doesn't give up performance on battery—but it drains that battery dry much faster.

In the end, chose the philosophy that works best for what you need in your laptop, and drive on.

Tested: How fast Qualcomm's new Snapdragon 8cx Gen 2 5G chip for PCs is

Performance has improved, though not by that much. **BY MARK HACHMAN**

HP's Elite Folio is the first laptop we've seen that's powered by Qualcomm's latest Arm chip, the Snapdragon 8cx Gen 2 (go.pcworld.com/n8cx). Yes, the Gen 2—supposedly a faster, more powerful upgrade to the Qualcomm Snapdragon 8cx. Is it? We tested the HP Elite Folio and the Snapdragon 8cx Gen 2 chip to find out just how fast it is.

This isn't a formal review. What we did was take HP's elegant, vegan-leather–wrapped tablet and run a few early tests on it to draw some immediate comparisons to previous reviews. While we typically run benchmarks several times to determine the average performance, in this case we've run our benchmark suite just twice—enough to ensure our results are accurate, however.

IMAGE: QUALCOMM

Our results have caveats. Remember that Qualcomm's Snapdragon chips are based upon the Arm architecture, a competitor to the X86 chips manufactured by both AMD and Intel. Apple ushered Arm into the spotlight with its M1 processor, an Arm chip now featured inside Apple MacBooks that compares favorably to Windows PCs (go.pcworld.com/cmfv). Qualcomm's latest chip (formally called the Snapdragon 8cx Gen 2 5G [go.pcworld.com/cxg2]) runs at 3.15GHz, versus the 2.84GHz of the prior Snapdragon 8cx.

Unfortunately, we aren't comparing the Snapdragon 8cx Gen 2 to the Apple M1 quite yet. Because both Apple's Mac OS and Windows were designed (or redesigned) to run on top of X86 architectures, code originally written for X86 chips has to be translated into Arm instructions via emulation. Apple's Rosetta technology facilitates this, and Windows translates 32-bit X86 instructions. Most apps run in 64-bit mode, however, which has meant that Snapdragon chips were unable to natively process 64-bit X86 applications. That changed in December, when Microsoft brought a 64-bit X86 emulator to Windows on Arm as part of its Windows Insider program (go.pcworld.com/86em).

Pay close attention to how it compares to 2020's Samsung Galaxy Book S (go.pcworld.com/gbks) and its first-gen Snapdragon 8cx chip, though, as well as the Microsoft Surface Pro X (go.pcworld.com/xspr), which used an upgraded version of the Snapdragon 8cx to create the Microsoft SQ1 processor. (Microsoft later refreshed the Surface Pro X with an upgraded version of *that* chip, known as the SQ2, which we haven't tested.) We've also included the Microsoft Surface Go (go.pcworld.com/sgo1) and Surface Go 2 (go.pcworld.com/sg02), two tablets that use Intel's Y-series processors for tablets. At the top of these benchmark charts are more traditional laptops, including 2019's Surface Laptop 3 (Ice Lake; go.pcworld.com/19l3) and 2020's Acer Swift 3 (go.pcworld.com/20s3).

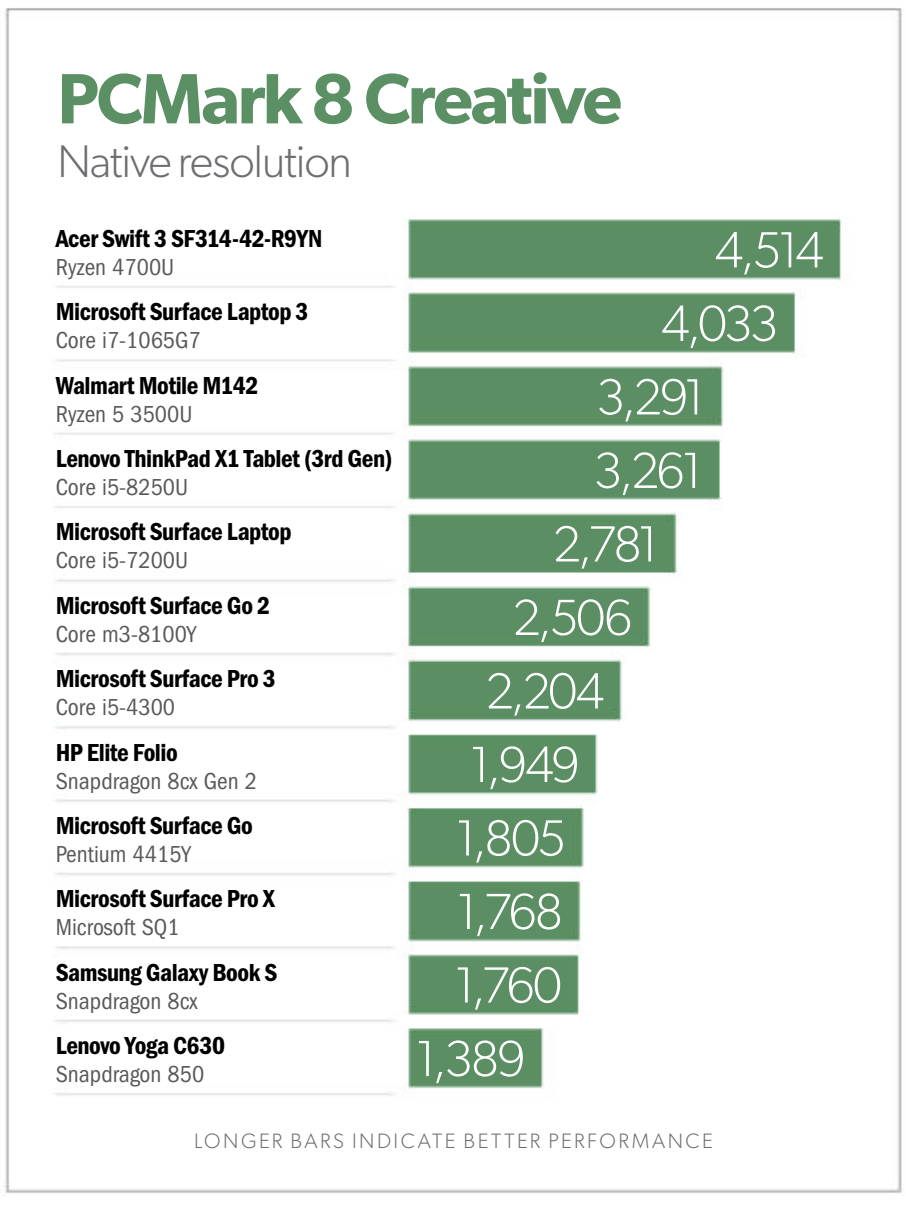
Oh, and the Lenovo ThinkPad X1 tablet (go.pcworld.com/tbx1) mentioned here is

HP's Elite Folio is a convertible that folds back into a tablet mode.

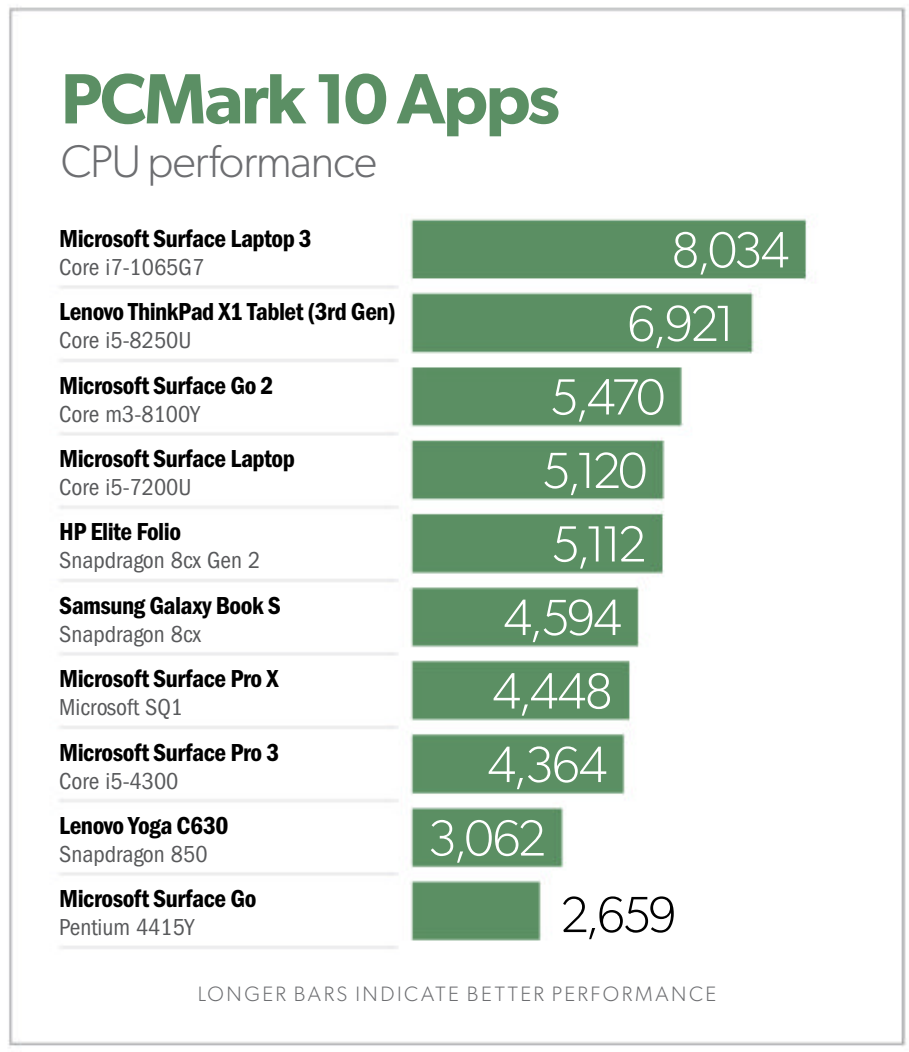
from 2016. We have its updated cousin, the Lenovo ThinkPad X12 Detachable, in house for testing, and we'll include those numbers in the Elite Folio's review.

QUALCOMM'S SNAPDRAGON 8CX GEN 2 5G, BENCHMARKED

UL's PCMark 8 isn't officially supported as a modern benchmark, though it provides a nice point of comparison to older devices where it is still in service. Like its more modern cousin, PCMark 10, PCMark 8's



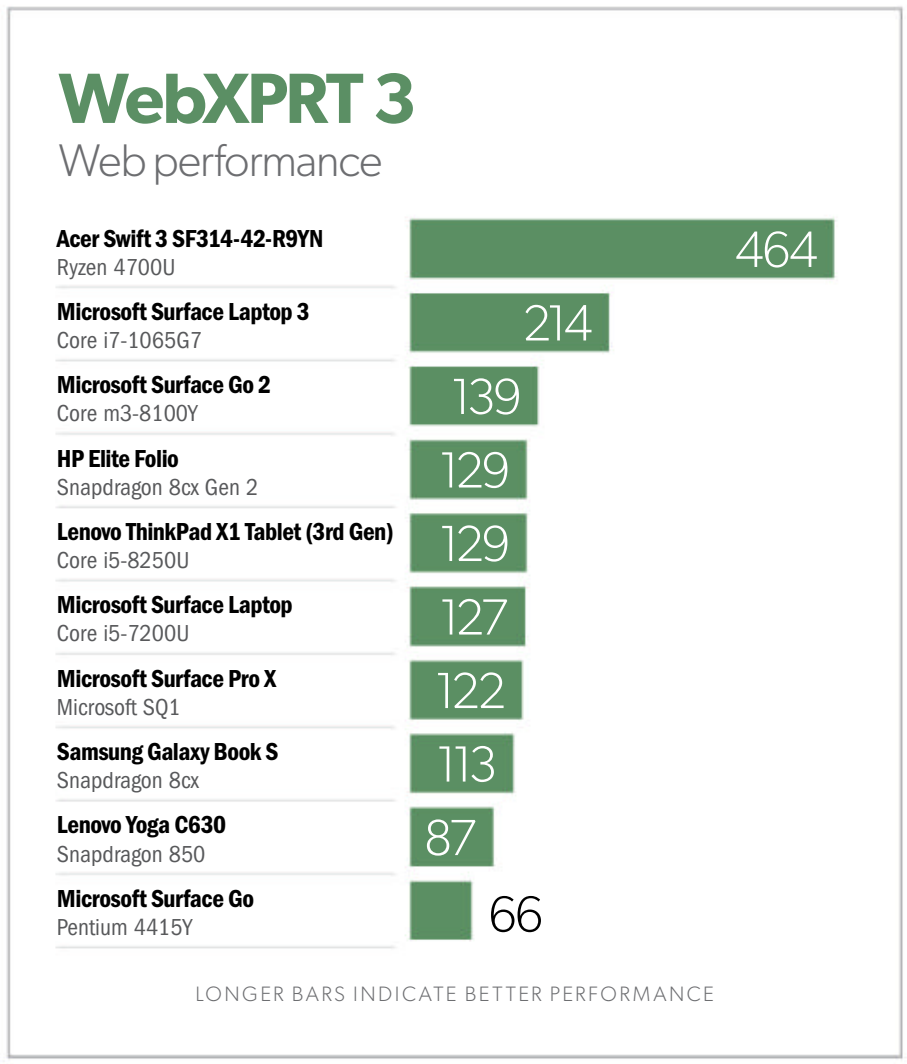
The Qualcomm Snapdragon 8cx Gen 2 5G processor inside HP's Elite Folio is moderately more powerful than its predecessor in the Samsung Galaxy Book S.



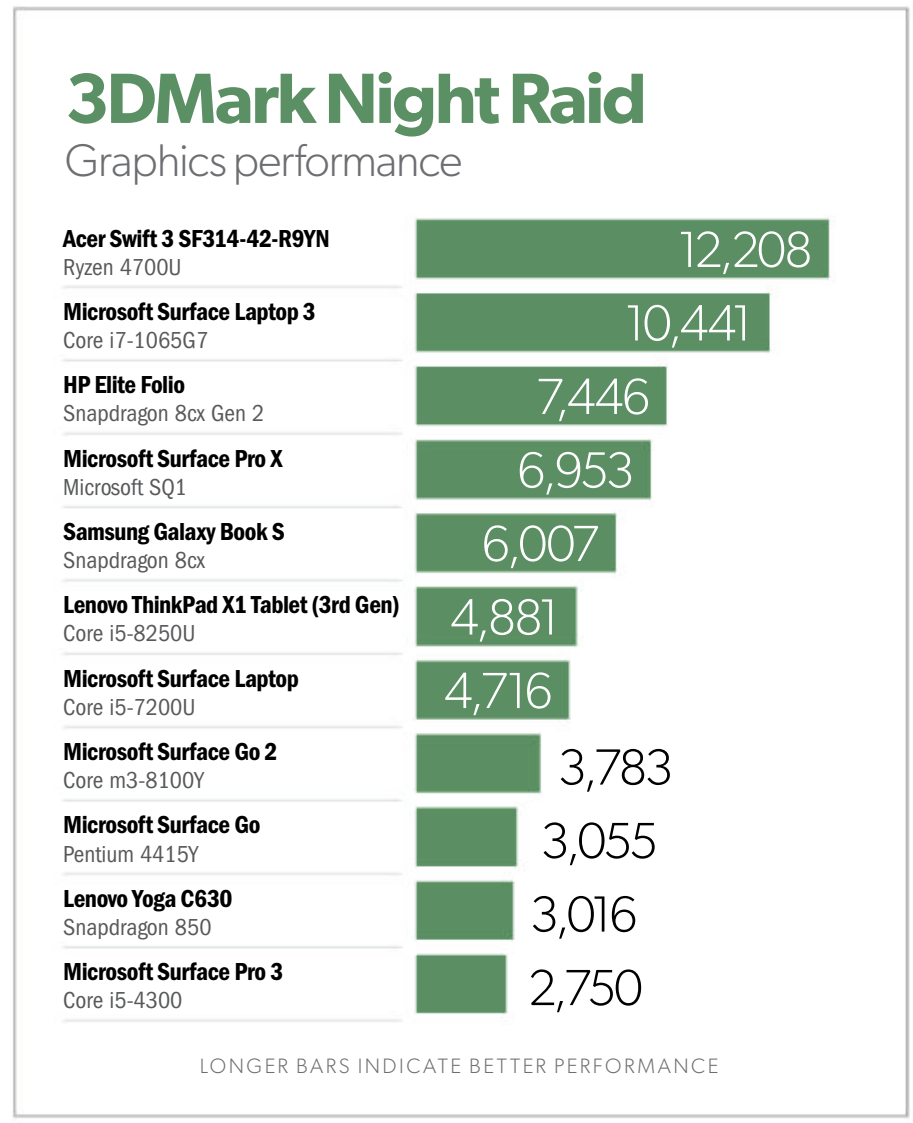
This is a heartening number if you're considering buying an HP Elite Folio. For day-to-day work within Office, the Folio performs decently. But Microsoft's low-end Surface Go 2 tablet still outperforms it.

Creative test includes tests for word processing and spreadsheets, but also web browsing and light gaming, plus photo and video editing. Unfortunately, this first test sets the scene: The Elite Folio and its Snapdragon 8cx Gen 2 processor represents a definite upgrade, but not enough to offer performance that competes with rival laptops.

As a 64-bit app, PCMark 10 won't run on the Elite Folio quite yet. Not to worry—a subset of the benchmark, PCMark 10 Applications, measures how well the notebook handles real-world Microsoft 365



WebXPRT 3 measures the performance of the processor performing Web-based tasks. Many notebooks run comparably to the HP Elite Folio.



Qualcomm's Adreno GPUs have always performed rather well in our graphics tests.

(formerly Office 365) apps like Word, Excel, PowerPoint, and the Edge browser. PCMark 10 measures how quickly apps open, as well as performance benchmarks like spreadsheet processing. Again, the HP Elite Folio and its Snapdragon 8cx Gen 2 processor offers competent, though not competitive, results.

We've traditionally included some Web apps in the mix, as they're naturally cross-platform tasks indicative of how work is done today. The WebXPRT benchmark doesn't get much use as opposed to dedicated apps, though we have enough benchmarks for a good comparison.

Finally, we typically look at the integrated graphics capabilities of the laptops we test. Intel's Core (and its Xe integrated GPU) and the Radeon cores found inside the latest Ryzen mobile chips don't need to appear here—this comparison against older laptops still shows the Snapdragon lagging well behind in 2021. UL's 3DMark "Night Raid" test was specifically designed for cross-platform comparisons, as it runs on both Arm and X86 chips.

BOTTOM LINE

HP tells us that the Elite Folio should include the graphics drivers necessary to allow it to

run 64-bit X86 apps. In the interest of fairness, however, we've stuck to the stable 32-bit Windows on Arm release that accompanied the Elite Folio. In part, that's to ensure that any glitches we find aren't due to a beta version of Microsoft's operating system.

Fortunately, the apps that we can run on the HP Elite Folio and its Snapdragon 8cx Gen processor in its current state already paint a fairly accurate picture of its performance, both in terms of traditional content creation and office apps, as well as graphics capabilities and even work on the Web. We'll upgrade the tablet to the Windows Insider version of Windows 10 later, so that we can run our more traditional benchmarks and evaluate Qualcomm's Snapdragon 8cx Gen 2 5G and the Elite Folio more fully.

Battery life, though, may be the real selling point. HP estimates that the Elite Folio will last about 20 hours, ever the strongest selling point for Snapdragon PCs. We'll test this and report back as part of our full review, which will also look at the aesthetic appeal of the Elite Folio, the cousin of the real-leather–wrapped Spectre Folio (go.pcworld.com/sfol).

HP is positioning the Elite Folio as an Office-and-email, every day use type of machine. That seems fair. We'll have to see how the Elite Folio and its Qualcomm Snapdragon processor hold up under day-to-day testing and if the claims of all-day battery life prove true. If performance is your priority, however, this likely isn't the laptop for you.

HP says the Elite Folio will last about 20 hours.

Crucial BX500 SATA SSD: An affordable upgrade drive

Add a lot of storage to your laptop for a budget price. **BY JON L. JACOBI**

Crucial's BX500 internal SSD offers a lot of capacity for not so much cash, along with great everyday, real-world performance. Most users will be perfectly happy with this QLC drive, as long as they don't bang on it too hard—as in writing large amounts of data in a short period of time, or filling the drive to point where it runs out of NAND to treat as cache. At that point, write performance drops to around the hard-drive level.

DESIGN AND PRICE

The BX500 is a 7-mm-thick, super-light, 2.5-inch SATA 6Gbps SSD. It comes in several flavors: The 2TB capacity we tested

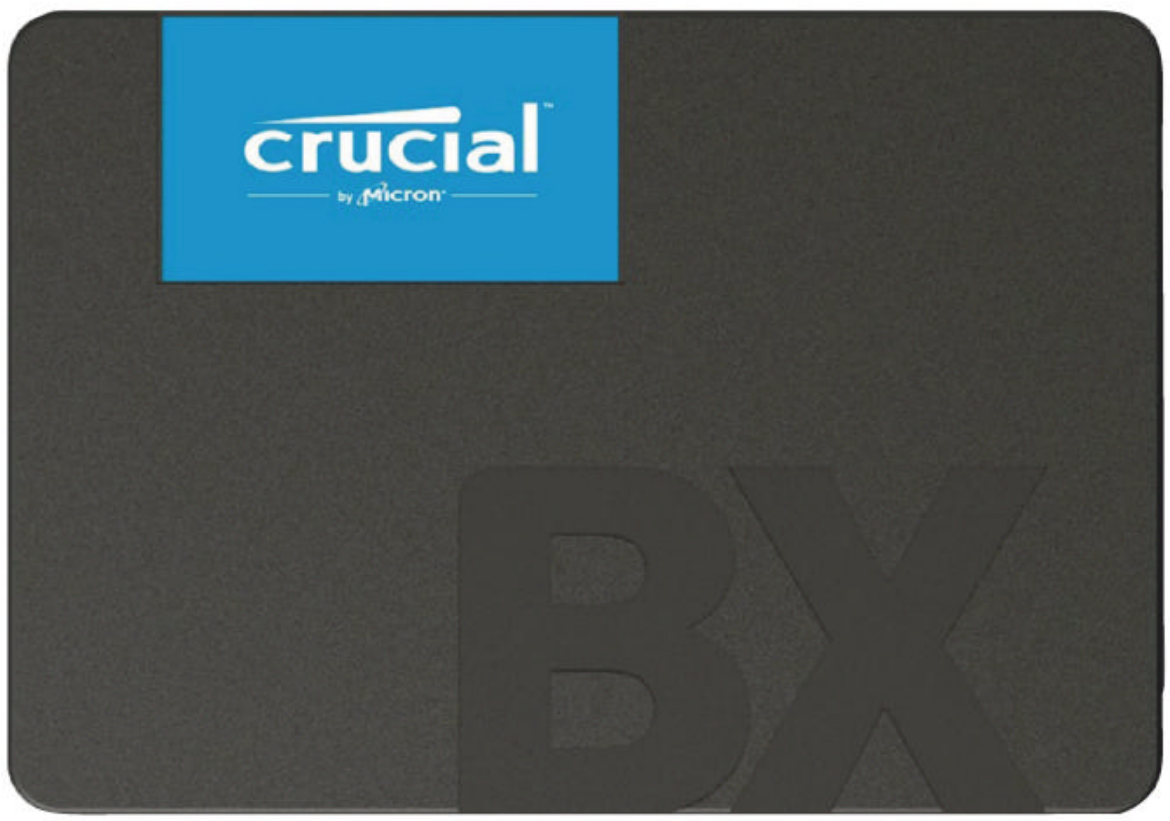
IMAGE: CRUCIAL

(currently $200 on Amazon), 1TB ($90 on Amazon [go.pcworld.com/90am]) , 480GB ($55 on Amazon [go.pcworld.com/55am]), and 240GB ($39.95 on Amazon [go.pcworld.com/39am]). That's about as cheap as you'll find, not to mention a rather interesting mix of capacities.

Normally you'll see 250GB and 500GB drives sold in product lines that feature 1TB and 2TB models, or conversely, 980GB and 1920GB with 240GB and 480GB drives. This is due to the percentage of NAND used for overprovisioning (allotting spare cells as replacements). Crucial obviously feels that the lower-capacity BX500s require more, which might have something to do with intelligent caching. Or not.

The BX500 employs a Silicon Motion SM2259XT controller. The four NAND chips inside our 2TB test model bore the OBY22NX894 marking. I found no reference to those NAND part numbers online; however, there were four chips on the rather small PC board inside the unit. The large drop in performance after running out of secondary cache during our long 450GB write test strongly suggests that it's QLC or quad-level cell/4-bit (16 voltage levels).

You won't necessarily find the same-density NAND chips in the lower capacities. All are rated for the same 540MBps reading and 500MBps writing, so the type of NAND and controller likely remain the same. Crucial does not promise that this product will use the same components throughout its life cycle, however—which could mean your drive won't perform the same as the one we tested (go.pcworld.com/1wet).

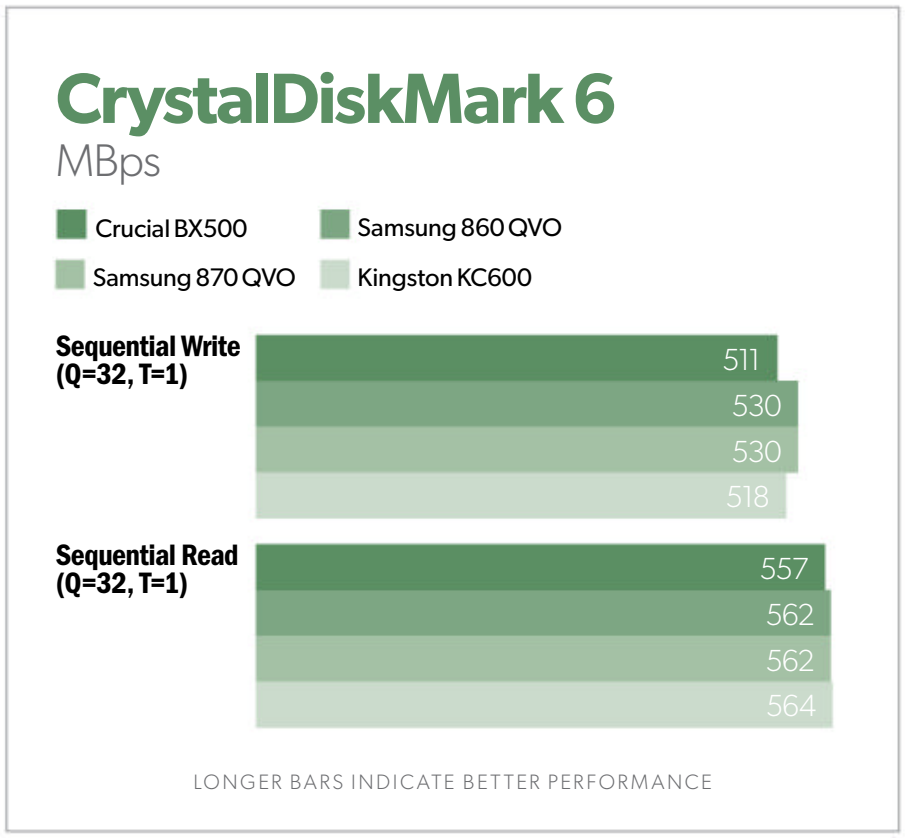


Crucial's BX500 makes a great upgrade in capacity for older laptops. Most users will never hit the drive hard enough to experience a write slowdown.

Note that the write speed estimate is for a virgin drive with enough NAND available to be treated as SLC cache—there's no DRAM on board. When the drive runs out of cache, as mentioned, write performance will drop significantly.

PERFORMANCE

Whatever the componentry, the 2TB BX500 is a very good everyday performer. Most users will never run into write slowdowns, at least with the

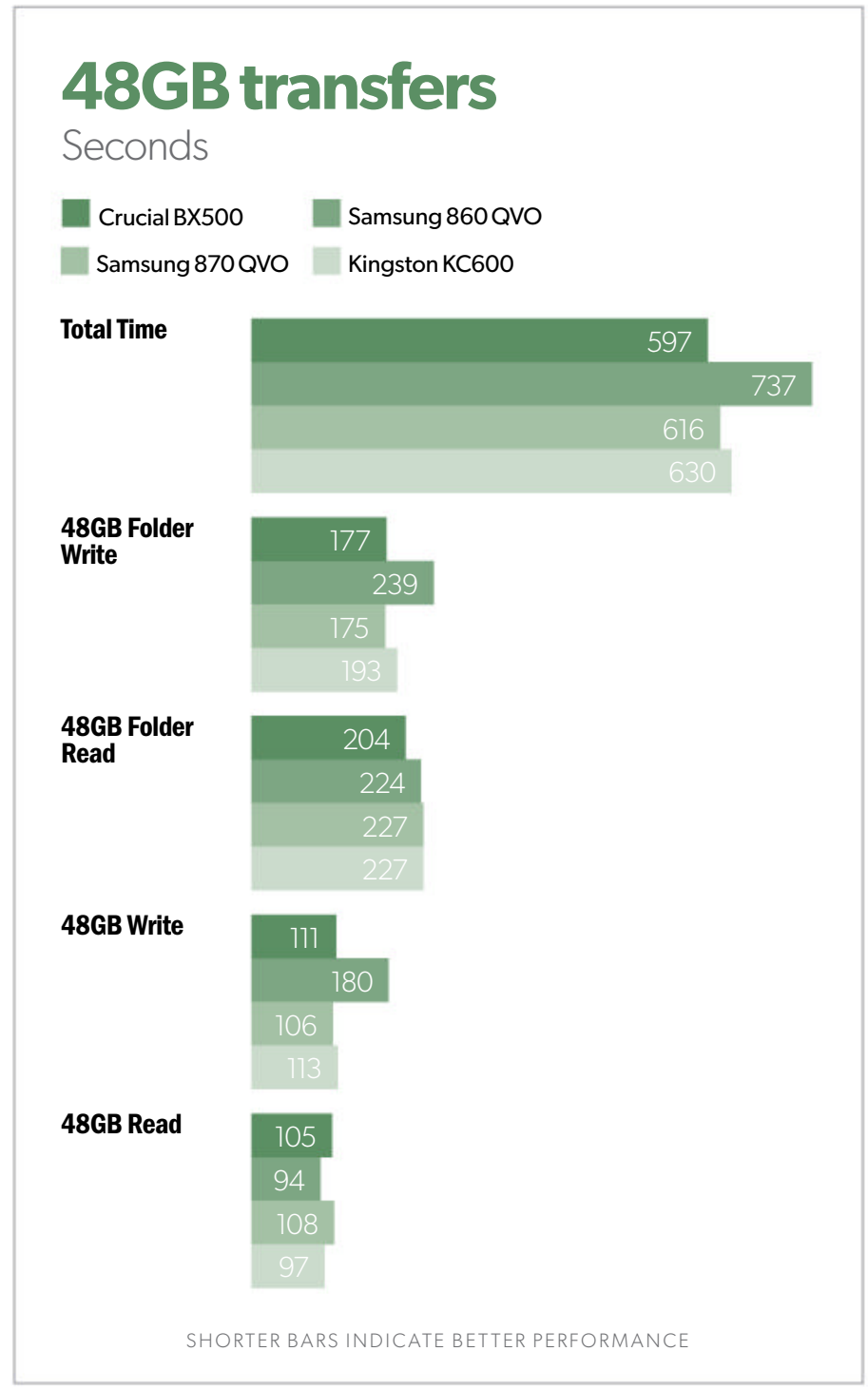


CrystalDiskMark 6 rates the BX500 as slightly slower than the competition, but just barely. During normal operation, you'd never notice the difference.

larger capacities. With the 240GB and 480GB drives, which have far less NAND to employ as cache, you might encounter slowdowns.

All but the best SSDs slow down when NAND cache is gone, with QLC being the slowest when this occurs. Also, the phenomenon will present itself more frequently in all drives as they fill up and there's less free NAND available for use as cache. That's why it's important to overbuy in terms of capacity with the vast majority of SSDs.

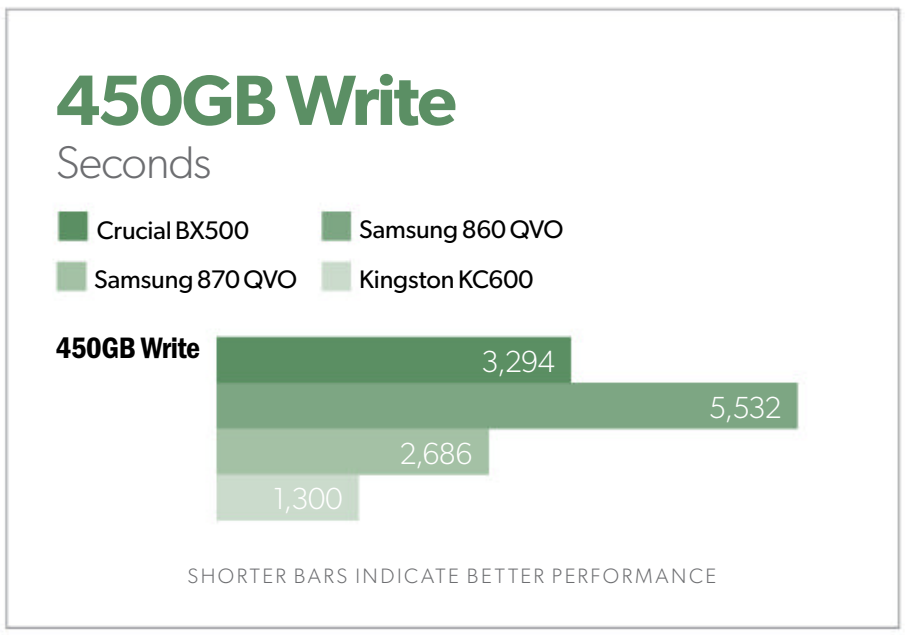
The BX500 actually led the pack (Samsung 860 QVO [go.pcworld.com/86qv], Samsung 870 QVO [go.pcworld.com/87qv], Kingston KC600 [go.pcworld.com/kc60]) in performance during our 48GB file transfers. These are more indicative of the occasional long writes that



For normal to large transfer operations, the BX500 is competitive and then some. It bested all the drives it's compared with in these real-world transfers.

most users might experience during backup or other heavy operations. But remember that these times were posted by the 2TB drive. The 240GB and 480GB BX500s are likely to hit the QLC write slowdown far earlier and post slower times than those shown overleaf.

You can see just how much the BX500 and other QLC drives slow down when they



While not as tragic as Samsung's older 860 QLC when it runs out of secondary cache, the BX500 slows dramatically. It's not the SSD you want for writing a large amount of data in a single blow.

run out of cache in the 450GB write times shown below. The much pricier Kingston KC600 is the only TLC drive in the charts, and the only one that doesn't slow down off-cache, if indeed it's even employing cache.

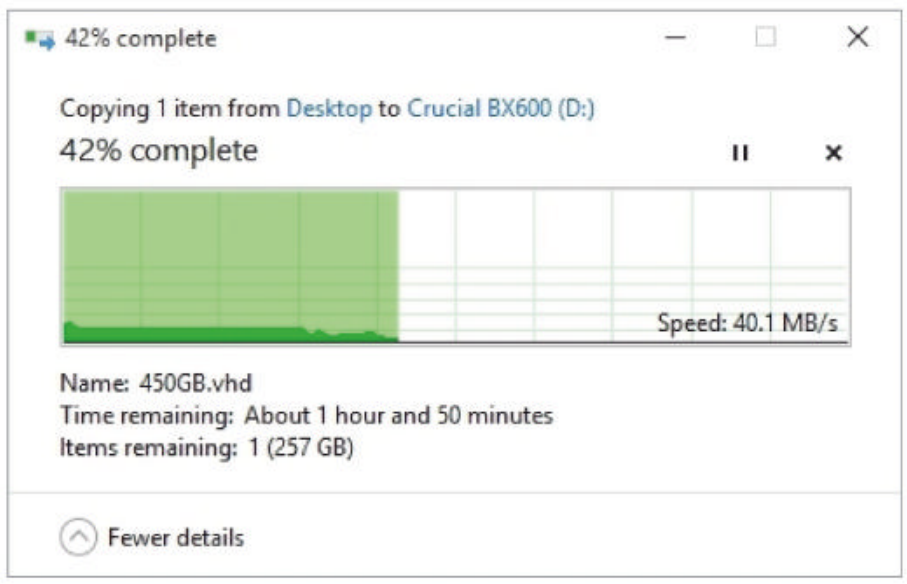
As you can see from the screen capture shown below, when the BX500 runs out of cache, write speed can drop as low as 40MBps—10MBps if the drive is caught doing housekeeping. It doesn't flatline there, however. It bounces between 40MBps and full speed, suggesting that more cache is being allotted in real time.

Our 2TB drive ran out of juice at around 140GB, so all things being equal, the 1TB drive would likely run out of cache at 70GB written, the 480GB at around 35GB, and the 240GB drive at around 15-17GB.

While we're compelled to talk about the slow write speed off-cache, again, this comes into play only when you write fairly large amounts of data—or as I said, when the amount of data stored approaches the capacity of the drive.

BOTTOM LINE

The BX500 is subjectively as fast as anything out there until it runs out of cache. That's likely to be a rare occurrence for the average user. Power users should skip it, but for everyone else it's a good deal. We do, however, recommend overbuying capacitywise by at least 50 percent.



As you can see, when the BX500 runs out of cache, write performance can drop as low as 40MBps.

Crucial BX500 SATA SSD (2TB)

★★★★☆

PROS

- Good everyday performance.
- Low price per gigabyte.

CONS

- Slows drastically when secondary cache runs out.

BOTTOM LINE

We recommend this QLC drive in the larger capacities for those that want good everyday performance for a budget price. The smaller capacities will likely run into more slowdowns during heavy writes.

$199

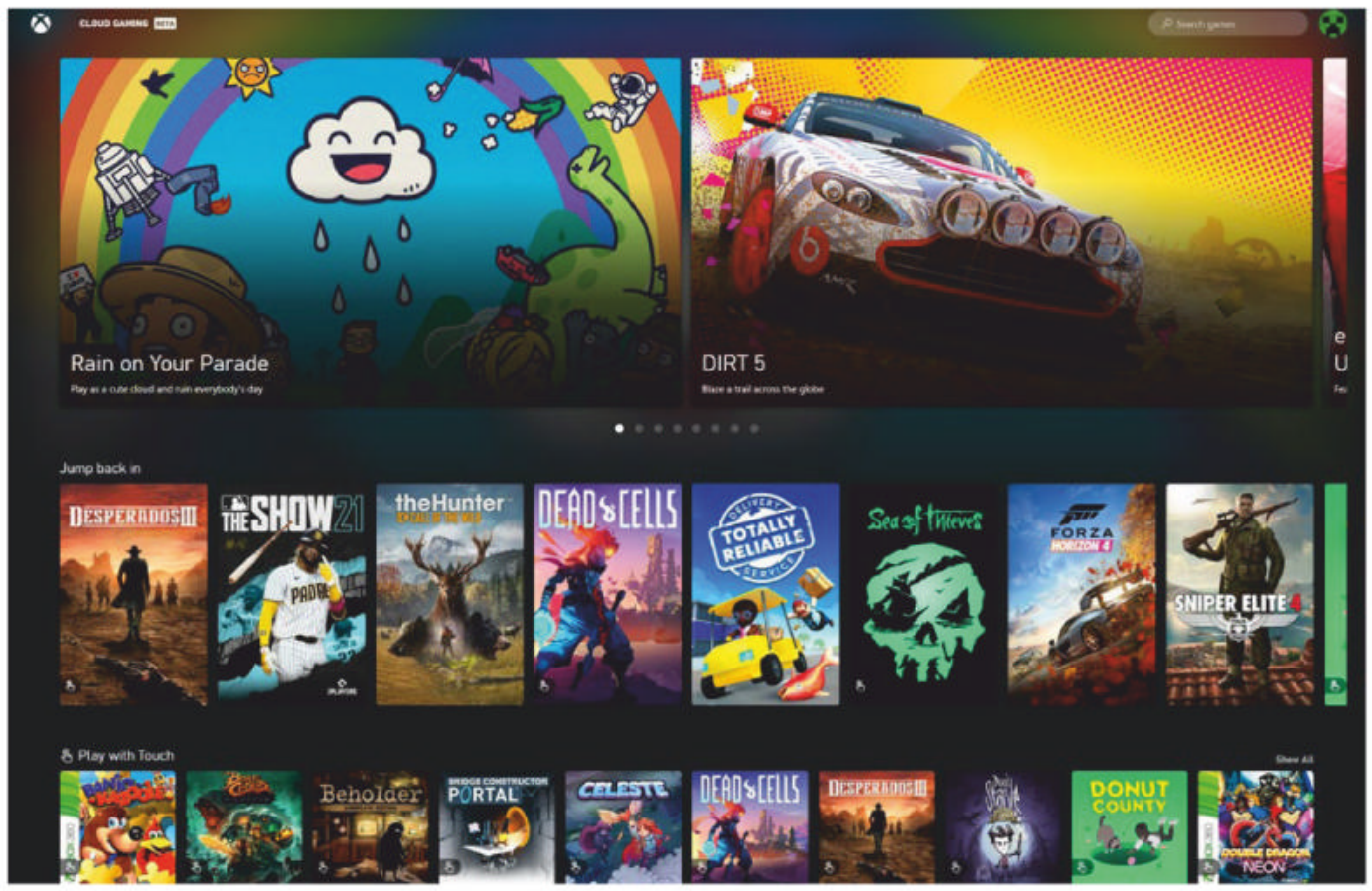
Hands on: Xbox Cloud Gaming for the web brings Xbox gaming to your browser

Stick to slower, story-driven games for the best experience. **BY MARK HACHMAN**

If you've just about given up on finding a GPU to build yourself a gaming PC, take heart: We've tried Microsoft's Xbox Cloud Gaming for the web, and it's not half bad. It is available in a limited beta for both the web as well as the Apple iPhone and iPad. (Xbox cloud access on the latter platforms has been hamstrung by Apple's draconian control of its App Store [go.pcworld.com/drac].) In any event, both Windows PCs and Macs now have access to playing Xbox games on Microsoft's cloud via the web.

There are two key ways in which Xbox cloud gaming is superior. First, you don't actually need a physical Xbox, especially one of the new Xbox Series S or X PCs, which are difficult if not impossible to find. Second, you don't need to download and install any games, saving you time (and possibly money, if your internet plan is limited by bandwidth or a data cap [go.pcworld.com/cpdt]).

IMAGE: MICROSOFT

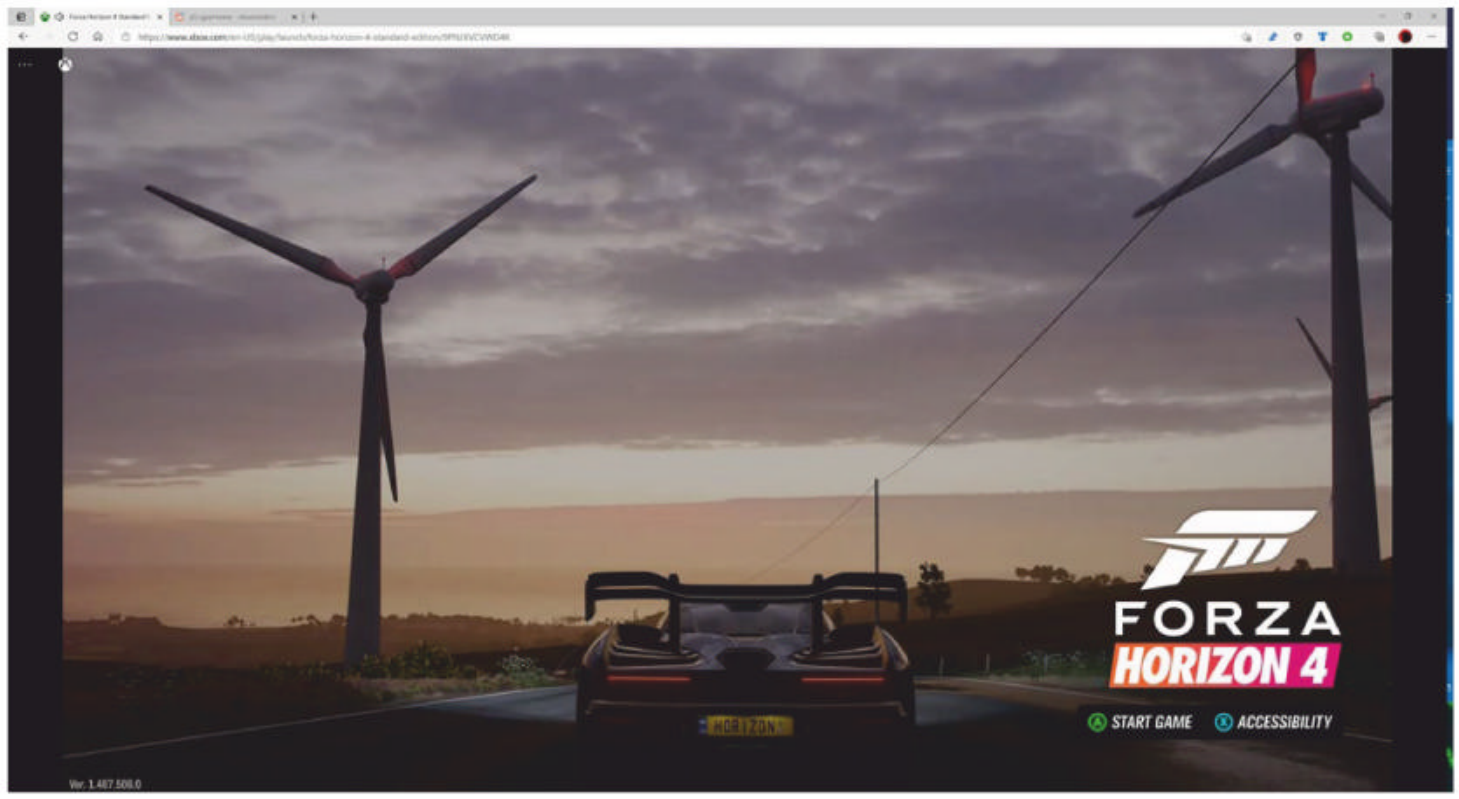


The Xbox cloud gaming main menu.

Previously, there were only two ways to play Xbox cloud games: on an Android tablet or phone (go.pcworld.com/atab), and on a Chromebook (go.pcworld.com/cr0m). The latter offered the most PC-like experience, with a keyboard and the ability to connect either a tethered or wireless Xbox controller. Now, however, users can go to the Xbox cloud gaming site (go.pcworld.com/xgms), log in, and start playing. You'll need to apply for a beta invitation to do so, before the site opens up to more general gameplay later this year. You'll also need to be subscribed to Microsoft's Xbox Game Pass Ultimate.

HOW WELL XBOX CLOUD GAMING WORKS ON THE WEB

Microsoft's cloud gaming differs from its other offering, remote play, in that you're essentially playing on a remote Xbox (reportedly an Xbox Series S) somewhere in Microsoft's cloud. That's important, given that Microsoft also offers a Game Pass for PC subscription (go.



This type of game is ideal for cloud gaming: slow-paced and not graphically demanding.

pcworld.com/xgpc). The difference is that Xbox cloud gaming offers games that are formatted for the Xbox running on the cloud; Microsoft does not yet offer the option of running PC-formatted games on remote servers. Games are also far easier to play and navigate on a large PC monitor or laptop display, as many games simply don't use large enough fonts to make them easily playable on a phone.

Microsoft has encouraged beta testers to use its own Surface hardware while playing the Xbox cloud gaming beta, but I found I really didn't have to. It ran fine on an HP Envy 14 (go.pcworld.com/14en)—which, to be fair, includes a discrete GPU. On the other hand, the service didn't need a discrete GPU, as it ran everything in the cloud. I hooked up an older Xbox One controller via Bluetooth, and started launching games.

Microsoft begins the Xbox cloud experience with a menu of available games, noting that many are actually touch-enabled. (That aspect didn't seem to work, even on a touch-enabled laptop.) Click one and you'll see a launch screen, during which Microsoft sets up your game. Some actions require you to click your mouse, while others ask you to use your controller; you'll get the hang of it. On my PC and broadband connection (about 200 megabits downstream to my home, during a day when remote schooling was going on), setting up the game in the cloud took about five to seven seconds.

Virtually batting against Clayton Kershaw is tough when you have lag and your own reactions working against you.

As was the case with many of the games, *Desperados* offered extremely limited visual options. If I had to guess, I'd say the stream was offered at 720p resolution. The text, however, was perfectly legible, and the game worked just fine when moving the window back and forth between a 4K external display and the laptop screen. There was, as expected, a detectable bit of input lag, but the game was absolutely playable. About the only aspect of it I was actually frustrated with was the abysmal load times.

The first game I tried was probably one of the lighter ones technically: *Desperados III*, an isometric third-person puzzle-esque game where you're tasked with moving characters around a battlefield of sorts and pulling off various maneuvers. Much of the game is spent waiting and planning, so frame rates aren't important. Don't spend too long making decisions, though, as Xbox Cloud Gaming will disconnect the game based on inactivity after a minute or two.

It seems that Microsoft can lighten its (graphical) load somewhat by not drawing as many pixels on the periphery of the screen, as part of a blurring effect in *Forza Horizon 4*.

First-person shooters do suffer somewhat under Xbox cloud gaming.

Dead Cells, a sprite-based 2D sidescroller that demands quick reflexes and button combinations, was the second game I tried. The input lag here was noticeable, but I found I could actually compensate for the slower inputs. When I died, I blamed it on myself, not the game.

Timing, though, makes a significant difference in some games, and you'll either want to dial down the difficulty or consider other options. A good example is the first top-tier baseball game that Microsoft has added to Game Pass: *MLB: The Show 21*. This game is extremely dependent on timing, especially when you're trying to catch up to a virtual fastball. On my local Xbox, I'm consistently a tad early in my timing when batting. Unfortunately, the cloud-gaming latency makes me swing late, and it's just a tad too jittery to factor that in when you're swinging.

It's different in driving games like *Forza Horizon 4*. As I found while playing *Forza* on the Chromebook, the input lag manifests itself in understeering, so that you'll start your turn a bit late and have to compensate. But I found that over time I was able to adjust and play about as competitively as I would on a local Xbox.

The real question, of course, is how cloud gaming plays on top-tier, graphically intensive, twitch-heavy first-person shooters. The answer is: We still don't have a precise idea, because games that are available on Game Pass haven't been ported to the cloud—the *Battlefield* games, for instance.

Some first-person shooters are available. *Wolfenstein: The New Order* is one, and while purists will notice some lag, I found that playing more strategically was possible. Gameplay was subjectively at 1080p resolution or worse, and the frame rates weren't great, either. Keep in mind, however, that this is an early beta, and the experience may improve.

Surprisingly, Microsoft has also added *PlayerUnknown's Battlegrounds* battle royale to the cloud library. I haven't played PUBG in years, and I was expecting to be killed off quickly, especially because the game notified me that I was being placed into a cross-platform queue, presumably with PC players. Luckily several other players (on the cloud? on Xbox? I don't know) were considerably worse than I was, so I survived for far longer than I had expected.

PUBG, never the prettiest game, still looked pretty horrific. While the game didn't seem to play at a particularly low framerate, the game's textures were simplified and ugly—again, that's not that unusual for the PUBG experience.

Granting that this is a beta experience, there's definitely room for improvement. But since I already "pay" for Microsoft's Game Pass Ultimate through Microsoft Rewards points, I'm essentially getting the experience for free.

Personally, I despise spending my time and bandwidth downloading big, bulky games that I'll eventually discard. I see Microsoft's Xbox cloud gaming as an opportunity to try out slower, larger, story-driven games that I may eventually choose to download locally, either for the improved graphics or more responsive gameplay. But there's definitely potential here, and it becomes even more valuable if you lack the available local Xbox hardware to take advantage of Microsoft's Game Pass games.

I hated the way PUBG looks within Microsoft's Xbox cloud, but I always did. I somehow managed to take out this poor soul, though.

8BitDo Pro 2: The best 'Pro' controller for $50

An upgrade in almost every way. **BY ADAM PATRICK MURRAY**

PCWorld EDITORS' CHOICE

The Pro 2 is the sequel to 8BitDo's SN30 Pro+ (go.pcworld.com/sn30)—a full-size controller designed with modern features and wrapped in classic gaming aesthetics. At first glance the new controller looks almost exactly like the old one, but it packs some welcome upgrades while keeping the cost at a more than reasonable $50 price tag. These features make the Pro 2 worthy of the "Pro" name and make it an easy recommendation for any gamer looking for a powerful and versatile gaming option.

Spec overview:

- Compatibility with Windows 7 and up, Android 4.0 and up, Nintendo Switch, macOS 10.10 and up, and Raspberry Pi 2B, 2B+, 3B, Zero

VIDEO: **8BITDO PRO 2 REVIEW : THE BEST 'PRO' CONTROLLER FOR $50**
Watch now at go.pcworld.com/8bd

IMAGE: IDG

- Bluetooth 4.0 connectivity
- 2 additional back paddle buttons
- Custom profile switch that can switch between the 3 profiles on the fly
- Mode switch toggle (Switch, macOS, D-input, X-input)
- 1000mAh Li-on rechargeable, replaceable battery that lasts 20 hours on a 4-hour charge over a USB-C connection
- Enhanced grip
- 6-axis motion sensor
- Fully configurable in Ultimate Software for PC and mobile

Bottom to top: SN30, SN30 Pro, SN30 Pro+, Pro 2.

8BITDO EVOLUTION

The Pro 2 builds upon the controller legacy that 8BitDo has laid down over the course of multiple years—so it's important to review how we got to this point in case you haven't been following. The company started out with a suite of hardware that was designed to bring modern features to classic hardware designs, with some of them primarily used for emulating classic games on current hardware.

Among one of the early releases was the SNES30 (go.pcworld.com/sns3) (later renamed to the SN30) that looked and felt just like a Super Nintendo controller. This allowed me to use one of my favorite controllers on my PC when playing A Link to the Past—and it was a real treat! Looking to expand its use, 8BitDo then released the SN30 Pro (go.pcworld.com/sn3p). It added to the classic look and feel of the SN30 hardware features that rivaled those of controllers from the major console manufacturers and allowed use with modern games. It's still one of my favorite controllers to have around thanks to its compact size.

The next logical place was to take the SN30 Pro and blow it up to full size, and in walked

the SN30 Pro+ (go.pcworld.com/snpl). Its full size made play feel better for those with bigger hands, and its new Ultimate Software allowed for a wide range of customization options. With this release it was obvious that 8BitDo wanted to play in the mainstream market, further moving away from catering to retro enthusiasts.

This brings us to the Pro 2. Gone are the naming and obvious color ties to the Super Nintendo—a move mostly likely made for legal reasons. It will make the naming transition a bit awkward if there is ever a sequel to the SN30 Pro, but these things are always a pain to deal with and it probably needed to happen.

Top: SN30 Pro+, bottom: Pro 2.

PRO 2 VS SN30 PRO+

From a hardware and software perspective, the Pro 2 is similar to the SN30 Pro+ in almost every way—but builds upon the already awesome frame with smart upgrades. From the size to the weight to the way it rests in the palm, the Pro 2 feels very familiar for those who used the older SN30 Pro+. The first notable improvement is in a textured grip, which helps with handling. It's a textured plastic so it's not the same kind of grip you would find on a higher-priced controller, but it has a nice touch.

The next upgrade is actually a pretty major one, and is where the Pro name really comes into play. The Pro 2 features two back paddles situated along the underside that are fully configurable in the newest version of the Ultimate Software (which I'll cover later). They are buttons that offer plenty of tactile feedback and sit flush enough with the handles so that they're actually a bit more comfortable to use than the raised paddles on other controllers like the Xbox Elite series. The switches feel identical to the face buttons and give a satisfying click when pressed. While I would have liked four paddles, two is still a welcome improvement over the SN30 Pro+. More control options are always better!

The next upgrade comes in the form of a hardware toggle along the backside between the paddles for switching input profiles. With previous 8BitDo controllers, the way you configured the input for use in different platforms was by holding down a face button while pressing the Start button to turn the unit on. Holding down X and pressing start would

Left: SN30 Pro+; right: Pro 2.

boot the controller into X-input mode for use on the PC, Y for use on the Nintendo Switch, and so on. While I ended up learning the various options, the setup was by no means user friendly. The Pro 2 solves this by allowing you to toggle between the four options with an easy flick—and that's 100% better. Sometimes it's just the small things that offer huge benefits, especially for gamers like myself who use the controller across multiple platforms often.

The next improvement to discuss is the addition of a Profile button situated between the two thumbsticks. You can assign to three different controller configurations easily inside the Ultimate Software and switch them on the fly. With a press, the button will toggle between the profiles in order with configurations loaded instantaneously. I found this useful for assigning different inputs to the back paddles for use in different game styles. I did find the button hard to hit sometimes because it was close to flush with the face of the controller.

The last notable difference between the two models was the slight shifting of some face buttons. To be honest, it always bugged me a bit that the Start and Select buttons on the SN30 Pro+ weren't situated evenly between the thumbsticks, but that was just a personal nitpick, not something that got in the way of using the device. For the Pro 2, those buttons have now shifted over to the symmetrical placement that I like. I'm not sure if that had a knock-on effect for the other face buttons, but those shifted slightly as well.

Top: SN30 Pro+, Bottom: Pro 2.

The inner distance between the Y and A button went from 1.7mm on the SN30 Pro+ to 1.4mm on the Pro 2. This change is very minor, and I could rely on my muscle memory while using the device, but it's still notable.

When it comes to the design, there are a few slight tweaks to cover before we move on. While the Black and G Classic options remain unchanged, the SN Edition found on the SN30 Pro+ has been replaced with a more generic Grey Edition. I was a huge fan of the Super Nintendo coloring on the SN Edition and I don't like the look of the Grey Edition, so that's a major bummer. I can understand making the change to further distance 8BitDo from Nintendo stylings, but the GameBoy design option still appears in the G Classic so I was confused on top of bummed. Of less importance is the loss of the circular styling around the face inputs—it was a nice design touch but it does give the controller a cleaner look.

THE SAME (MOSTLY) GREAT EXPERIENCE

Everything else about using the SN30 Pro+ applies to the Pro 2—and that's a good thing! The controls are nice and tight, and offer the right amount of feedback for even the most demanding games. The sticks and triggers offer good resistance and the feel of each under my finger and thumbs is very comfortable. 8BitDo has always nailed the feel of the classic D-pad as well, so there was no need to change that winning formula.

As 8BitDo moves away from the classic stylings it's focused on, I do hope it moves away from the flat face design. While it works for small controllers, I find myself reaching just a bit to hit up on the d-pad and the X button more than I would on a more traditional controller shape. If you are sensitive to joint pain in your thumbs, you might want to consider that extra strain if you put a lot of time on a controller.

When it comes to the Ultimate Software, it's almost identical for the Pro 2—but it is a different download from the SN30 Pro+ option. Configuration options are still plentiful, including the ability to fine-tune thumbstick start and stop distances and even

swap trigger inputs. Other than the ability to map custom key presses on the PC, it's got everything you'd need.

When the controller is first plugged into the PC, you are now presented with platform options that give you the ability to assign different mappings depending on which platform you want to use. You can configure this regardless of which input is currently enabled.

The only hangup I've encountered in using the software is around custom mapping. The labeling on the face buttons features the Nintendo standard layout with Y on the left, B on the bottom, X on the top, and A on the right. This can be confusing if you are using it in X-input mode, which has X on the left, A on the bottom, Y on the top, and B on the right. So, for example, if you are in X-input mode and go to map a face button to a back paddle, you want to make sure you are mapping the X-input rather than what is printed on the face button. I had to do the mental hurdle of thinking, "The X input is mapped to the Y button on X-input mode, so I need to put X on P1." After sorting through that initial confusion, I was fine, but it is something to note.

Speaking of mapping the back paddles, I also got hung up on the fact that P1 and P2 are labeled left to right according to how it's

viewed from the bottom. So when you are holding the controller normally, P2 is actually on the left and P1 is on the right. That also tripped me up when I configured the options.

Moving back to hardware experience, the Pro 2 ships with the same 1000mAh battery as the SN30 Pro+. No, really, it's exactly the same battery! The unit I received contained a battery with a SN30 Pro+ label on it. Regardless of the naming scheme, I get great life out of it and the fact that it's replaceable is a huge bonus in case its life diminishes over time. On top of that, the form factor allows for standard AA batteries if you need that option. It really is a win-win-win for users considering that most controllers lock you in with a nonreplaceable battery or only have an option for AA use.

And PC users can still have the Pro 2 wired in via the USB-C port. This is a helpful feature for those who don't have the option to use Bluetooth or who want the lowest-latency connection possible.

BOTTOM LINE

All of the hardware upgrades make the Pro 2 a great improvement over the SN30 Pro+, which was already one of my favorite controllers out there—especially on the PC, where you can use the controller via USB and quickly customize configurations inside the Ultimate Software. The Pro 2 adds up to being one of the best controllers out there, regardless of price. It's just the cherry on top that it costs $50 and offers so much.

8Bitdo Pro 2

★★★★½

PROS

- Superb input feeling.
- Deep customization with the Ultimate Software.
- Additional input options.

CONS

- Flat face design isn't the most comfortable.
- A few mapping options are missing or confusing.

BOTTOM LINE

The Pro 2 from 8BitDo builds upon the fantastic SN30 Pro+ in smart ways through hardware and software features that make it a truly Pro controller, and one of the best out there.

$50

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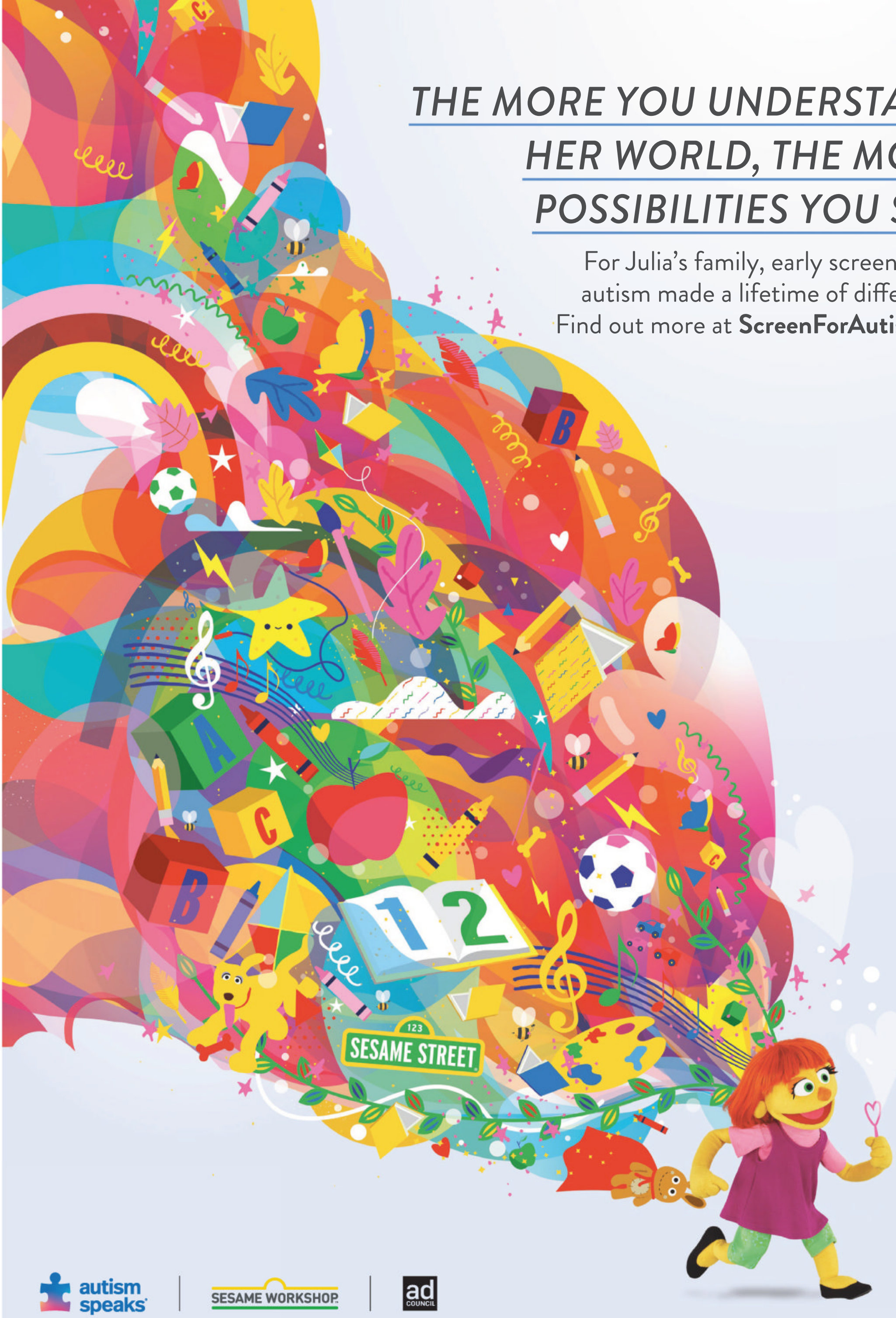

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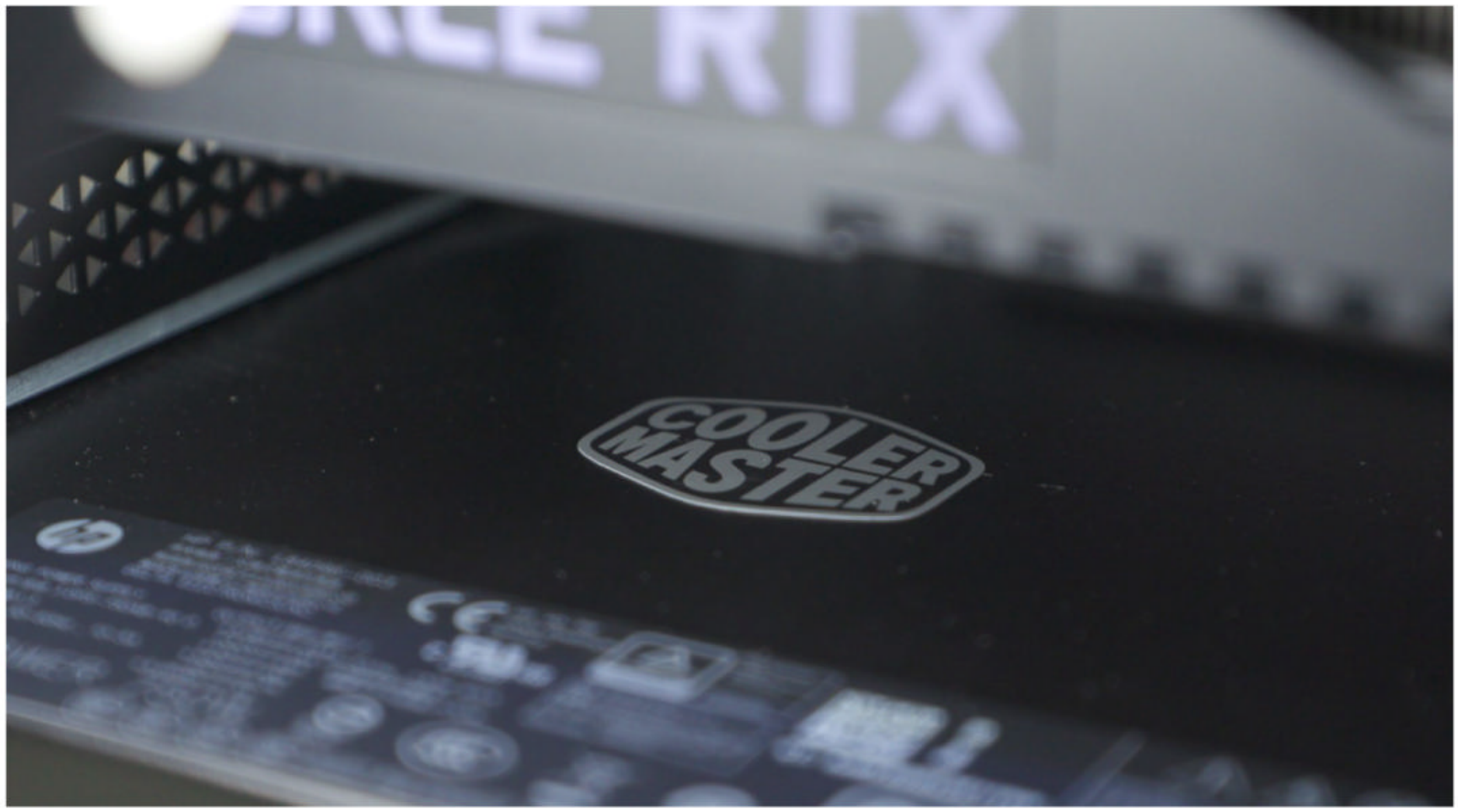
THE HP OMEN 30L IS A *NEW* KIND OF PREBUILT GAMING PC

WE CAN GET BEHIND THE TREND OF PREBUILTS WITH CLEAN, ATTRACTIVE INTERIORS THAT ARE A SNAP TO UPGRADE AND THAT DON'T COST AN ARM AND A LEG TO BUY. **BY ALAINA YEE**



You'll easily spot the logos from well-known component manufacturers within this PC, backing up HP's claim that it's no problem to swap in off-the-shelf parts.

With component prices soaring right now, computer builders are starting to eye prebuilt PCs as the quickest way to replace an aging system—or to scratch that itch for a brand-new gaming rig. We ourselves have even recommended buying a prebuilt PC (go.pcworld.com/prpc) instead of going DIY as a strategy.

But some DIY builders remain skeptical of prebuilts, especially those from big companies like Dell and HP, and for good reason. Not so long ago, prebuilt gaming PCs came equipped with proprietary motherboards and power supplies, making common DIY upgrades difficult. (You couldn't easily swap in a beefier graphics card, for example.) The parts in those same prebuilts often didn't perform as well as what you could get off the shelf for a DIY build.

But as you can see in our video, we cracked open an HP Omen 30L to find that times have changed. Not only does the Omen line sport configurations with high-end hardware like Core i9 processors and RTX 3080 graphics cards, but the 25L and 30L

VIDEO: **WHAT DOES THIS HP PREBUILT REALLY HAVE INSIDE?**
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models are designed for easy upgrades down the line. Getting into our 30L's case was a snap, and components like the CPU cooler and power supply are simple to replace. Adding more storage is a breeze, too.

That's true for both experienced DIY builders and complete PC novices. HP designed the Omen to steer newbies in the right direction, while not getting in the way of seasoned veterans. Not only can you download a service manual from the company's website, but the key areas in the PC are simple to access or clearly labeled. Conversely, areas that could get an inexperienced builder in trouble are more out of reach. This training-wheels approach feels smart, especially for anyone who has to provide remote support to a friend or family member trying to do upgrades on their own for the first time.

This thoughtful design isn't the biggest plus of the Omen 30L, however—unlike the prices for smaller boutique builders like iBuyPower (go.pcworld.com/ibpw) and CyberPower PC (go.pcworld.com/cbpw), prices haven't risen as quickly on HP's premium gaming PCs. That advantage held by juggernauts like HP and Dell has always existed, but it's a real boon in combination with the fresher, more DIY-friendly approach. You can see all the details in our video and check out the available configurations, which change based on real-time supply, at HP's online store (go.pcworld.com/hpon).

Getting into the HP Omen 30L's case is a snap—just press the Internal Access button.

The Omen 30L's key areas are easy to access.

5 GREAT SECURITY TOOLS BUILT RIGHT INTO WINDOWS

WINDOWS HAS SOME GREAT BUILT-IN SECURITY FEATURES TO HELP KEEP YOUR PC SECURE. **BY IAN PAUL**

Windows 10 has a fantastic set of built-in security tools. In recent years, Windows Defender (go.pcworld.com/wnde), the built-in antivirus for Windows 10, has performed as well as (and sometimes even better than) the major third-party suites.

Many of Windows 10's security features are turned on by default, such as Windows Defender's real-time malware scanning and scheduled quick scans. Still, there are items that are either not enabled by default or have a lot more to offer than you may realize at first glance.

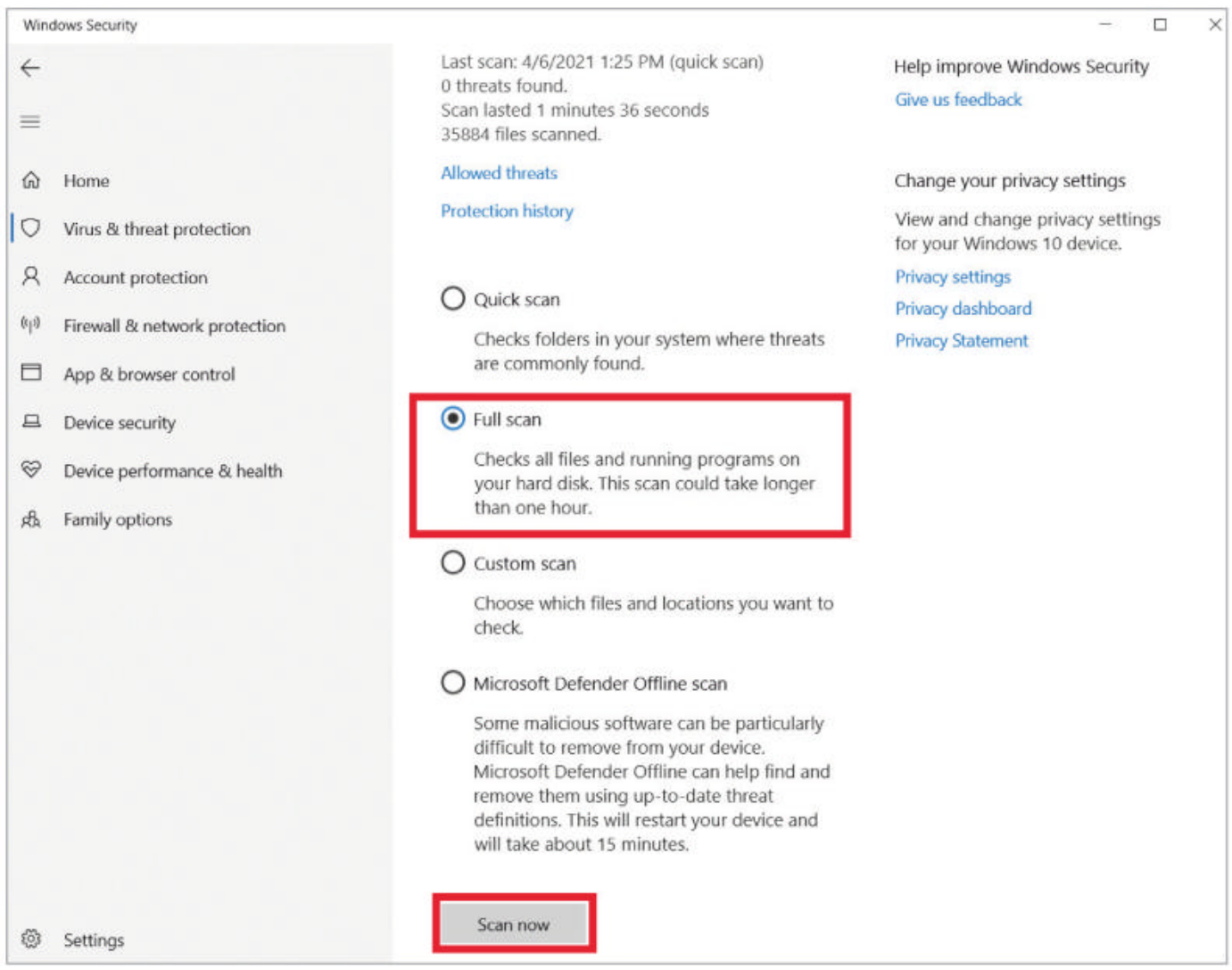
Here are five Windows 10 security tools that are well worth knowing about.

1. SCAN OPTIONS

You can easily get by with Windows Defender's automated scanning regime, but did you know you can carry out manual scans just as you can with third-party antivirus suites? By default, Windows Defender carries out a quick scan that checks the places in your system where malware is most likely to hide.

If you'd like to go deeper, however, there's a full scan option. To access it, click on the Windows Defender shield icon in the system tray. When Windows Security opens, select "Virus & threat protection." In the next screen under "Scan options," select the Full scan radio button, scroll down to the bottom, and select Scan now.

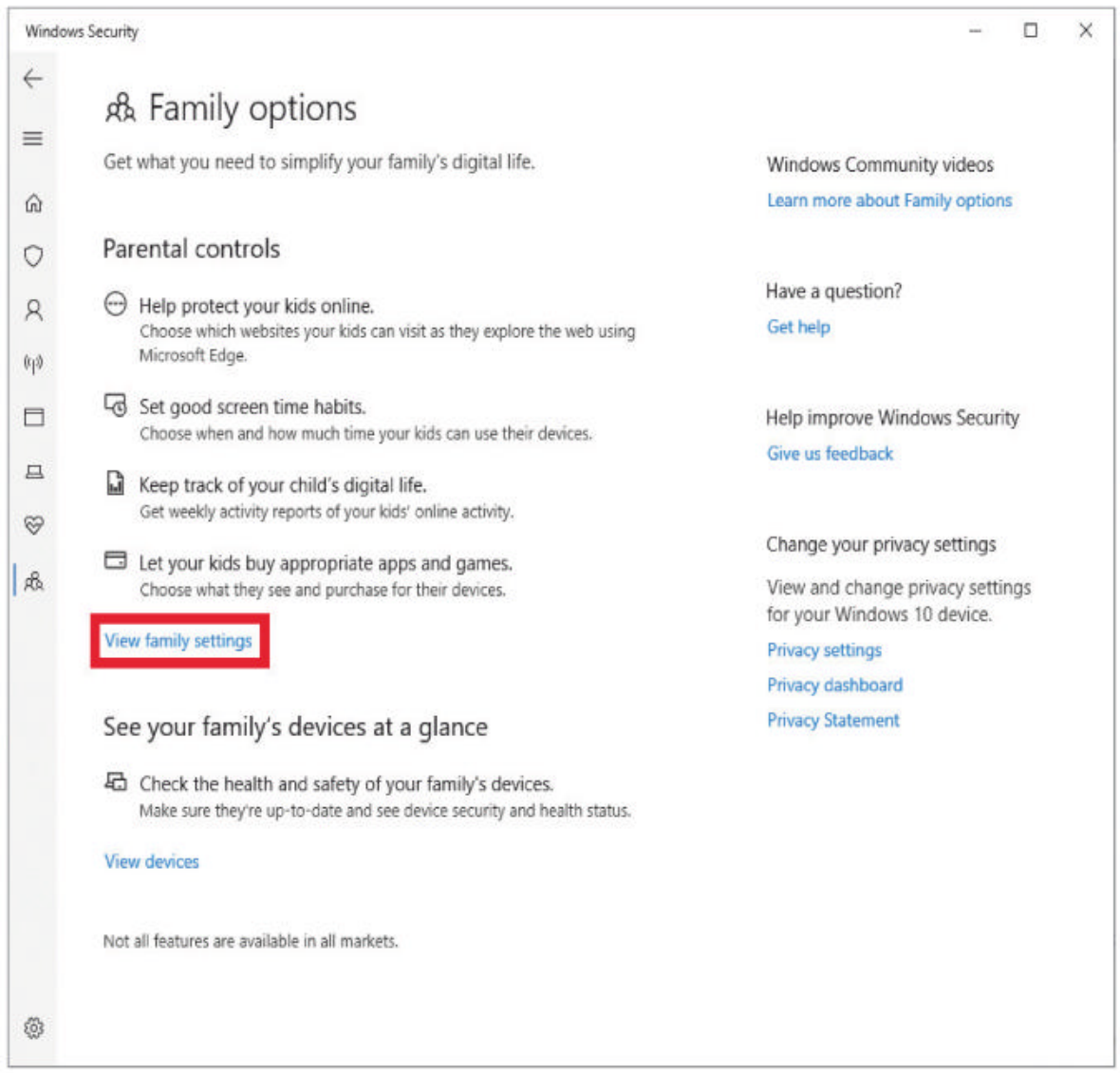
While it's easy to run a manual scan, scheduling a full scan to run every week is not so easy since it requires using Windows 10's Task Scheduler.



Windows Defender's scan options.

2. PARENTAL CONTROLS

Microsoft provides a full suite of parental controls that are particularly effective when you live in a Windows 10 world. For this feature to work, your children



Launch Windows 10's built-in parental controls from the Windows Security app.

will need to be signed in to Windows PCs or an Xbox with their own Microsoft email accounts, not local accounts.

You can use parental controls to set screen time limits, create content filters, and restrict certain apps and games. You can even give your children an allowance to spend on apps and games and monitor their purchase history. If they're carrying a laptop with them, you can also locate their devices on a map.

To get started with parental controls in Windows 10, open Windows Security and then select Family options > View family settings. This will launch a website where you can manage parental controls.

3. SYSTEM RESTORE POINT

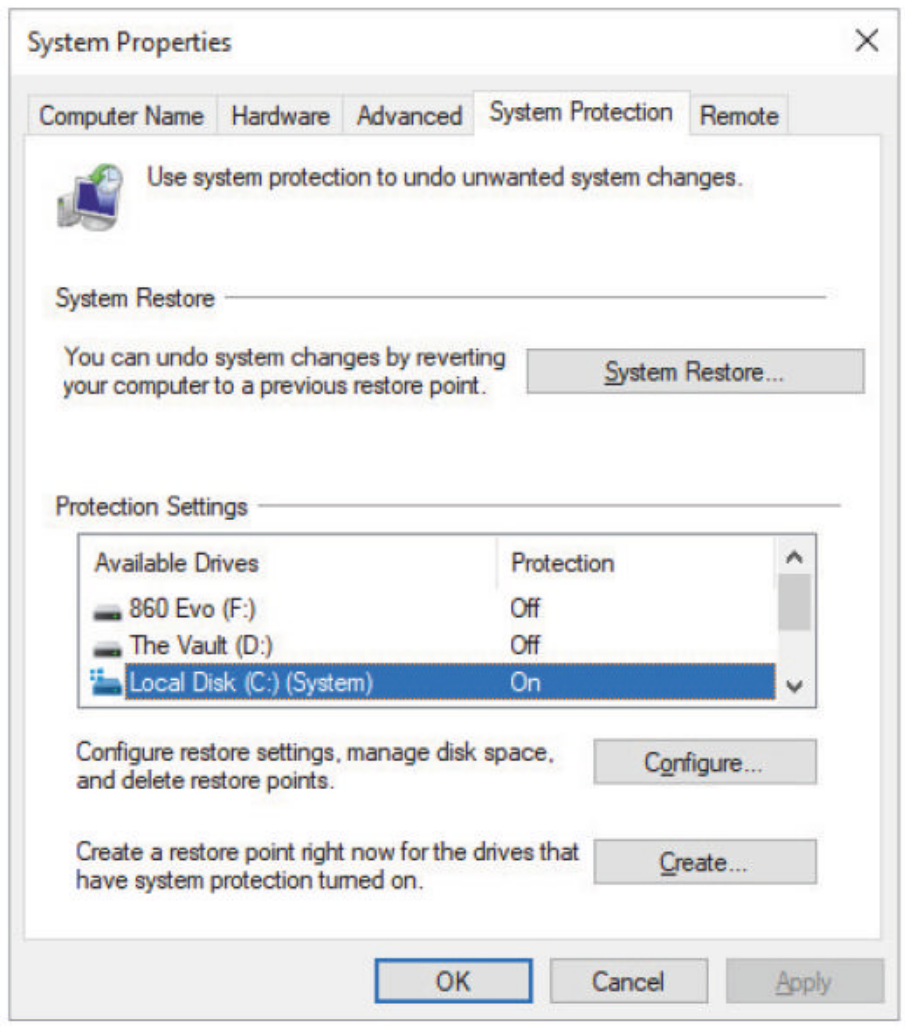
This is not a security feature per se, but it shares the same goal as many security programs, namely system integrity.

It's always good to have a fallback position in case something goes wrong with your PC. Windows 10 provides options to reset your PC, but that wipes out all installed programs (you can choose not to erase personal files) with a fresh copy of Windows. A system restore, on the other hand, returns your PC to its last known good state.

This can be a helpful tool when you accidentally mess up your system or you want to get rid of an annoying program that won't uninstall. It can also help neutralize some mild forms of malware if they haven't affected your system restore points, and then a deeper malware scan can usually get rid of what's left.

A System Restore will not help you retrieve lost personal files and documents. For that you need to conduct regular backups (go.pcworld.com/regb).

Having a system restore point is just a good idea. To activate System Restore, type "system restore" into the desktop search bar, and select the "Create a restore point"



option. This opens an old-school tabbed utility window. Select the disk that says (System) next to it (usually it is C:), and then select Configure.

In the next window that opens, select the "Turn on system protection" radio button. If you'd like to set a maximum usage for a system restore, you can also adjust the slider under Disk Space Usage.

Once that's done, click Apply and OK, and then close the original window or click OK one more time.

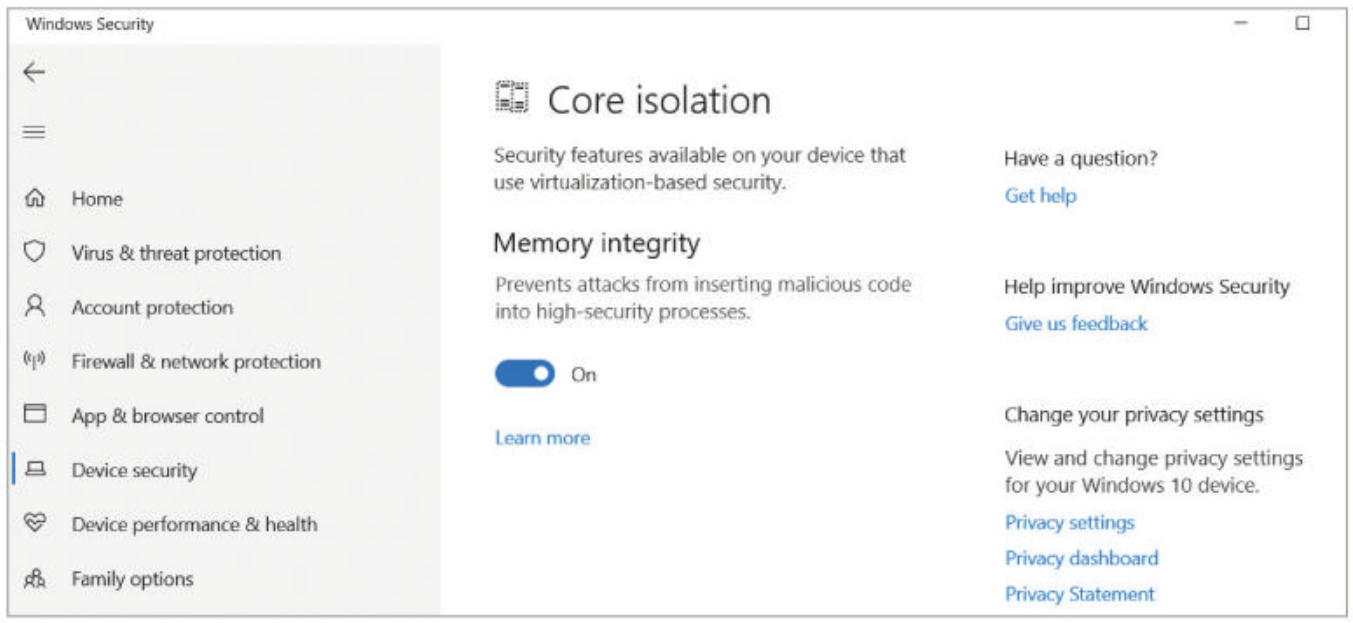
4. MEMORY INTEGRITY

Memory Integrity is a security feature that's part of a larger set of security features within Windows 10 called Core Isolation. The basic idea with Memory Integrity is that it creates a virtualized environment inside a chunk of system memory. This environment is isolated from the rest of the system and runs critical Windows processes that make sure system drivers and other important processes haven't been tampered with. The idea is that isolating this activity makes it much harder for advanced malware threats to get into core parts of your system.

Memory Integrity can be active out of the box on newer PCs, but if you have an older system or you built your own desktop PC, it probably isn't. There can be several reasons for this. For starters, third-party developers are still making their code compatible with this security measure, which means the feature can cause problems with some older device drivers.

If you built your own PC, then it may not even support Memory Integrity, as it requires a trusted platform module (TPM) 2.0 chip. This can be either a physical chip built into the motherboard or a software-based TPM called an fTPM—both are enabled via the BIOS when available. Virtualization programs like Oracle's VirtualBox or VMWare can also have issues when Memory Integrity is active, which is mostly a problem for developers and power users.

Clearly, Memory Integrity is not for everyone right now. The good news is that Microsoft does a scan of your system before activating the feature to make sure Memory Integrity can run.



To activate Memory Integrity, open the Windows Security app, then go to Device Security > Core Isolation > Core isolation details. Under Memory Integrity, turn the feature on using the slider button.

If your PC starts to experience issues after you turn this feature on, you can turn it off using the same set of steps.

5. DYNAMIC LOCK

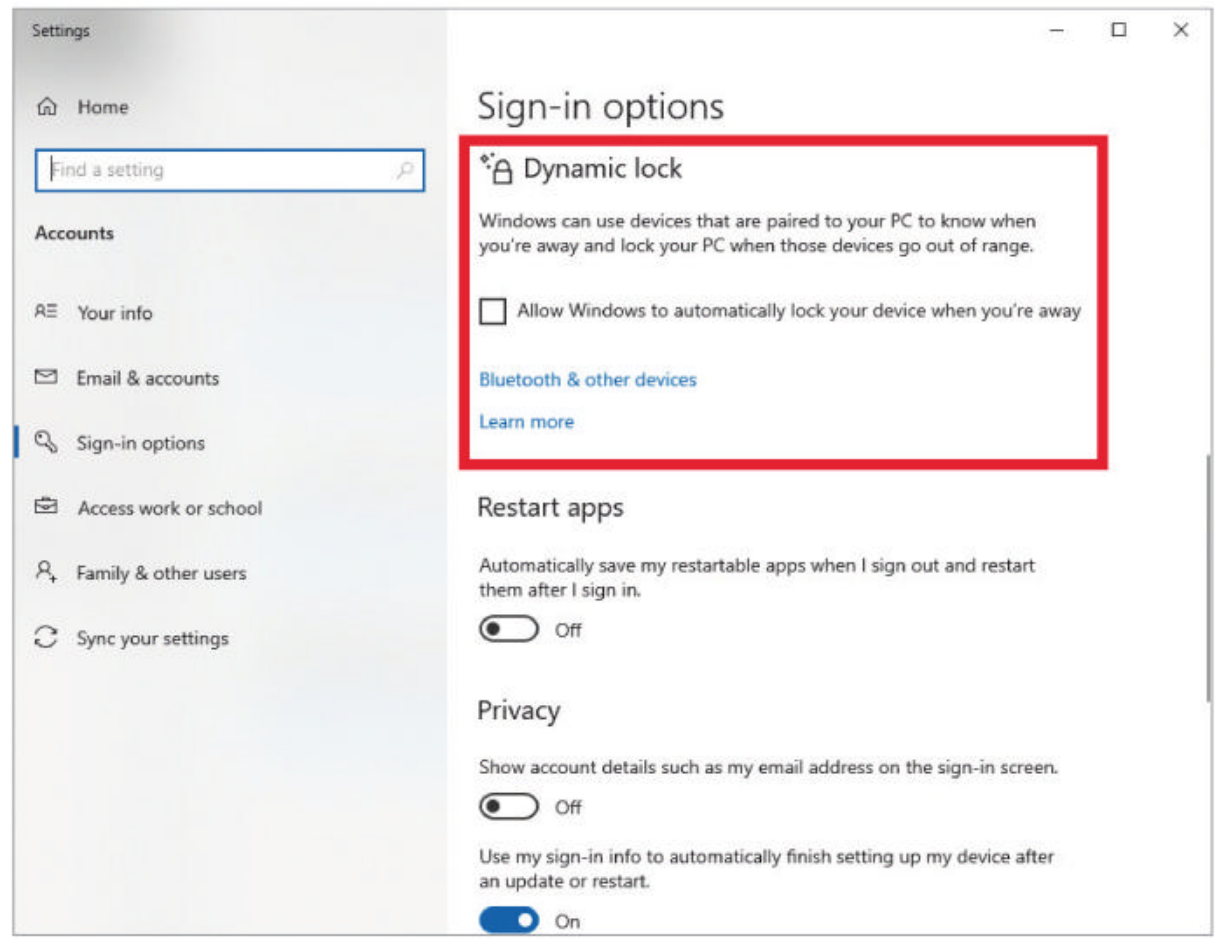
If you'd like to lock your PC automatically when you're away from the computer, Dynamic Lock can help. After pairing your phone to your PC via Bluetooth, you can automatically lock your device whenever your phone is out of range.

It's dead simple to set up if your PC has Bluetooth. Start by connecting your phone to your PC via Bluetooth. Open the Settings app by tapping the Windows key + I. Next go to Devices > Add Bluetooth or other device. In the next screen that opens, select Bluetooth. Then choose your phone and follow the instructions to pair the devices.

Next, activate Dynamic Lock by navigating to Settings > Accounts > Sign-in options. Under "Dynamic lock" click the checkbox that says "Allow Windows to automatically lock your device when you're away."

That's it.

You don't necessarily need to use all of them, but knowing about these Windows 10 features can help make your PC a lot more secure.



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How to spot an online scam: Three dead giveaways

It's easy to be fooled by scammers online. But it's just as easy to spot those scams if you're paying attention. **BY IAN PAUL**

It's surprisingly easy to fall for an online scam even if you're hyperaware of all the ways bad actors can trick you. Online scammers are playing a numbers game. If they send out their scams to enough people, they'll find a few people who posses a magic combination: folks who are distracted by life and also concerned about the status of their online accounts.

That's how I almost fell for an online scam. My credit card bill was coming due, but I was busy that month, and paying the bill was just one of many things percolating in the back of my mind. Then I suddenly got an email stating my bank was freezing my account if I didn't log in. "Oh no!" I thought. "I'm late paying my bill."

Without another thought, I clicked on the link in the email, even though I knew the right

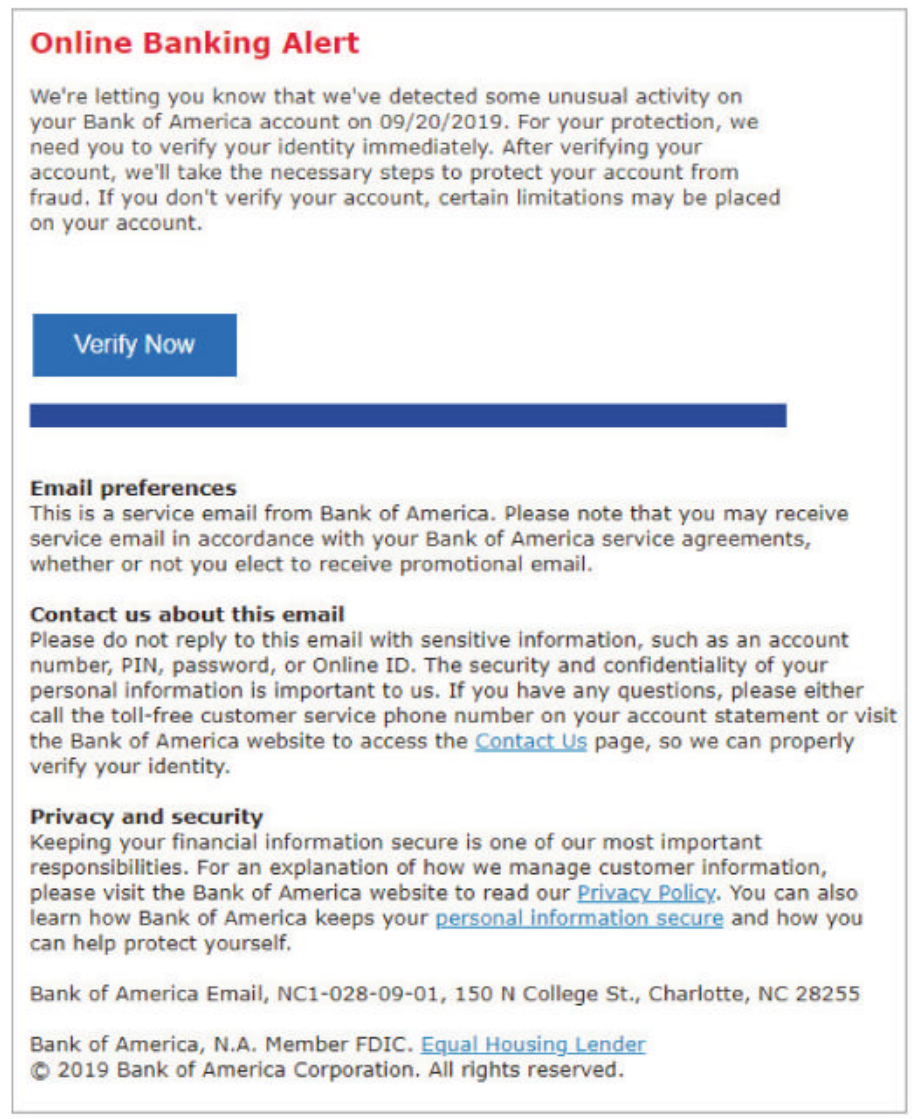
IMAGE: DR. DRAWER / THINKSTOCK

thing to do was type out the URL myself. I was just about to put in my login details when another thought came bubbling to the surface: Something seemed not quite right.

I checked the website address, and sure enough I was about to enter my details into a phony website designed to harvest login credentials from my bank. It was a near miss. I had almost been the victim of phishing. This happened despite the fact that I've reported on just these kinds of exploits. Heck, I'd even written several articles with security tips about how you should never click on a link to your bank from inside an email.

Caught at the right moment of vulnerability, anyone can fall for an online scam. When you're prepared, however, spotting an online scam is a fairly straightforward procedure. Then when the stars align to make you susceptible to an online scam, you might save yourself by knowing what to look for.

Here are some basic rules you can use to keep yourself and your online accounts out of the hands of the bad guys.



Online Banking Alert

We're letting you know that we've detected some unusual activity on your Bank of America account on 09/20/2019. For your protection, we need you to verify your identity immediately. After verifying your account, we'll take the necessary steps to protect your account from fraud. If you don't verify your account, certain limitations may be placed on your account.

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Please do not reply to this email with sensitive information, such as an account number, PIN, password, or Online ID. The security and confidentiality of your personal information is important to us. If you have any questions, please either call the toll-free customer service phone number on your account statement or visit the Bank of America website to access the Contact Us page, so we can properly verify your identity.

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An example of a scam banking email.

RULE 1: IF YOU'RE NOT EXPECTING IT, YOU SHOULDN'T EXPECT IT

A standard trick for online scams is to get you to click on a link. This link can show up in an email, a hijacked messaging account of one of your friends, a WhatsApp message, or even an SMS. The idea is to direct you to a malicious website. Then the scammers will try to download malware onto your device, or trick you into revealing your login credentials on a phony website that looks like the real thing.

The best way to combat these scams is to never clink on a link you weren't expecting. If you get an email stating that your bank account is about to be frozen or your PayPal email account suddenly needs to be validated, don't click. Even if you check that the email address and the link are leading to the real thing, just as a matter of security don't click. Instead, enter the website address yourself by typing it out in the address bar. Don't search for it—instead type it out yourself.

Then, once you've logged in to the legitimate website, you'll be able to see if whatever the email claimed was real.

Tip: A good way to avoid falling for a phishing website is to use a password manager and its browser extension. If you land on a website that isn't legitimate, then the extension won't supply your login details. Indeed, even if a website has a tricky URL like paypal.com.098uq3409847890.net, it shouldn't fool mainstream password managers.

RULE 2: DON'T BUY INTO URGENCY

A classic scam is for someone to hijack a person's Facebook account and then contact all her friends via the hijacked account. Often the scammer will claim some kind of emergency, saying your friend is in jeopardy, such as "I'm in London. I've been robbed, and I have no money."

When you know this is a scam, you can see where it's headed. In the moment of urgency, however, it can be harder to spot. Of course you want to help your friend: "Oh, my goodness! A foreign country where they might end up on the street? I need to help."

Because an "emergency" is in play, scammers are banking on the likelihood you won't look too closely at the details and instead will just take action. But on your end, you must resist the urge to act immediately. If your friend is in dire straits, you can still ask to talk to her on the phone, or verify with someone else over the phone that she truly is where she claims to be. The key is to talk to another human being whose voice you can recognize, because pretending to be someone else via a text chat is so easy. Do not, however, take the word of some "hotel manager" or a supposed good Samaritan who's speaking on behalf of your friend.

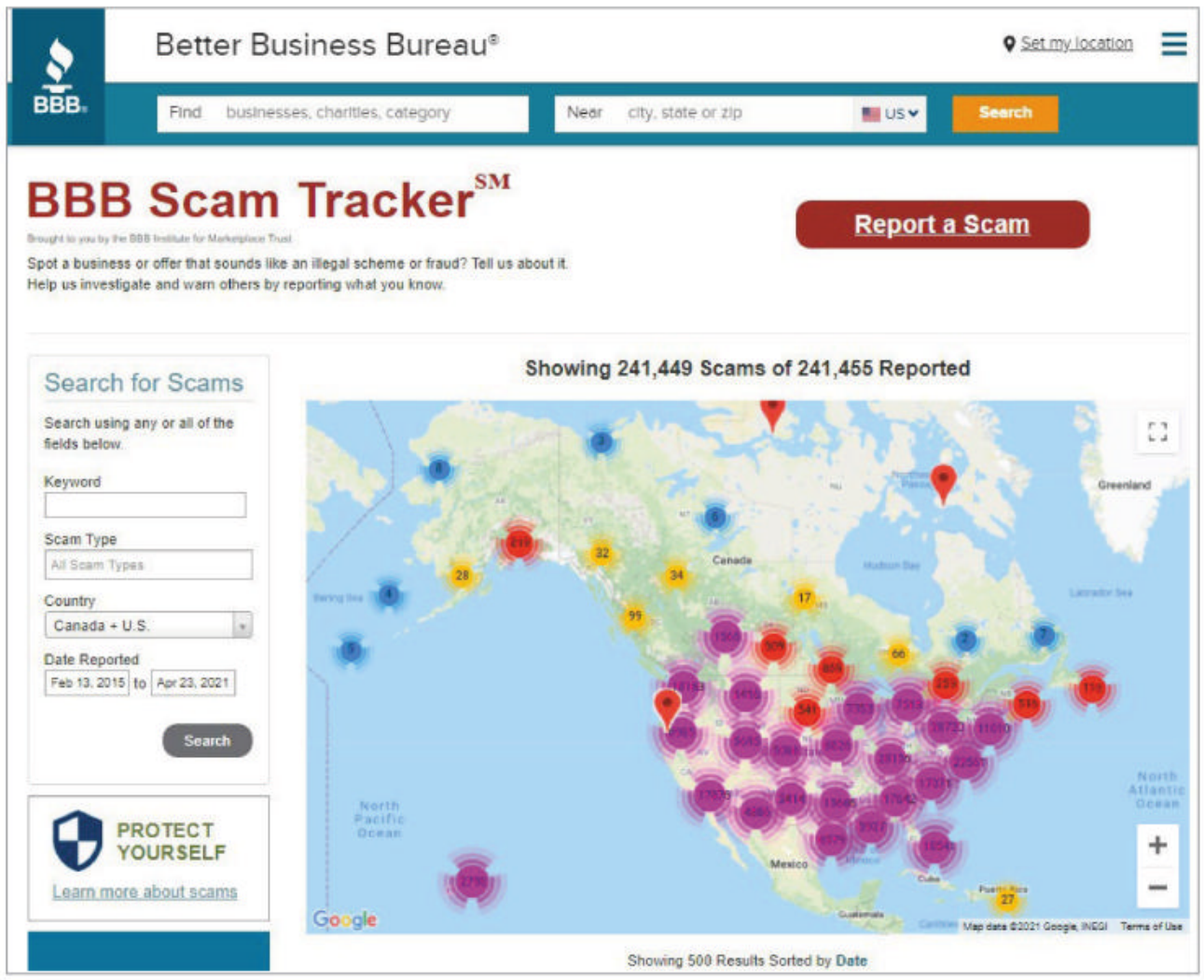
You can apply the same basic principle when it comes to taking immediate action to unfreeze your account. First, a bank or credit card company is more likely to call you or send a letter about dramatic action rather than drop you a note in Gmail. Nevertheless, if you want to be sure, type in the URL of your bank or credit card manually to visit the site. If there is truly a threat to your account, the institution will alert you once you log in.

RULE 3: IF IT'S TOO GOOD TO BE TRUE…

If it's too good to be true, then it probably is. This may be a cliché, but it's also a good rule of thumb. Money doesn't just come tumbling out of your inbox, after all. If a lawyer or business contacts you via email about making a tidy profit on a business transaction or reclaiming some kind of inheritance money, don't fall for it. This sort of thing just doesn't happen, no matter how legitimate these offers may seem.

This also goes for online sales. Yes, you can find some fantastic sale prices on

Amazon, Best Buy, and other places online. But if you get an email or see a link on social media leading you to an incredible sale price on a site you've never heard of, then take a step back. Do some basic research using consumer sites like Trustpilot, Sitejabber, and the Better Business Bureau to see what others have to say about the business. What you're looking for is overwhelming evidence that the site is legitimate. If you don't find any information about the site or only a few sparse reviews, that is a huge red flag.



The Better Business Bureau's Scam Tracker.

ADVANCED TIP: HOVER OVER LINKS

The next time you get a legitimate email from your bank, try this trick for practice. Hover the cursor over the button or link your bank wants you to click without actually clicking it. Next, look in the lower left corner of your browser window. You should see the web address the link will take you to.

That's an easy way to spot a scam, because a bad link will never lead to your bank's website, and scammers will often use a link-shortening service in the attempt to hide that fact.

There are a few other things you can watch out for, such as poorly worded emails and chat messages, though this is becoming a less reliable guide in recent years. Another red flag is when someone asks for money in a nontraditional form like a gift card or a cash reload card. Even requests for a wiring money can be suspect. The FTC has a good video (go.pcworld.com/ftcv) on what to watch out for when being asked for money via the phone or online.

The Internet is a great place to find information and manage your life, but it can also be a place where it is far too easy to get duped if you're not paying attention.

How to see what Google knows about you and delete it

Google, like many other big tech companies, knows a lot about you. **BY IAN PAUL**

Google collects a lot of data about you if you use the company's services. To its credit, the company makes finding and deleting that data easy by showing most of it on a single website. Here's how to see the bulk of what Google knows about you, and how to delete it if you want.

Once you delete data from your Google Account, the company immediately starts removing it and stops using it for personalization. "We then begin a process designed to safely and completely delete the data from our storage systems," Google explains (go.pcworld.com/gxpl). It may be forced to keep some information to satisfy

IMAGE: GOOGLE/GERD ALTMANN, MODIFIED BY IDG COMM (CC0)

legal requirements, which you can read about at the link just provided.

GOOGLE ACCOUNTS

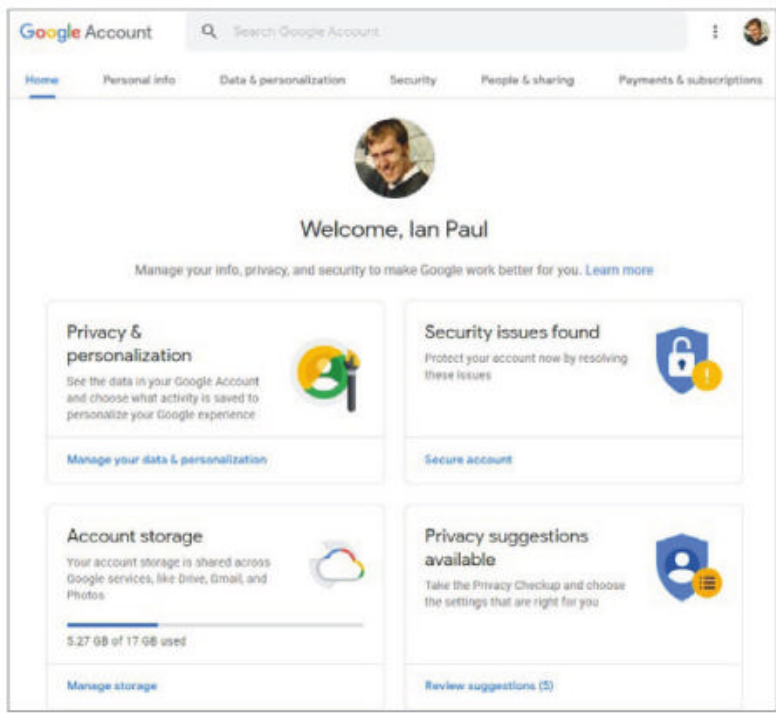
The primary starting point to see what information Google has about you is the My Account website (go.pcworld.com/goac). From here you can find the information you've supplied, as well as data the company gathered in the background.

The My Accounts site offers a set of tabs at the top, as well as some informational tiles covering topics such as security and privacy issues with your account, how much available storage you've used, and a quick link to the personalization section.

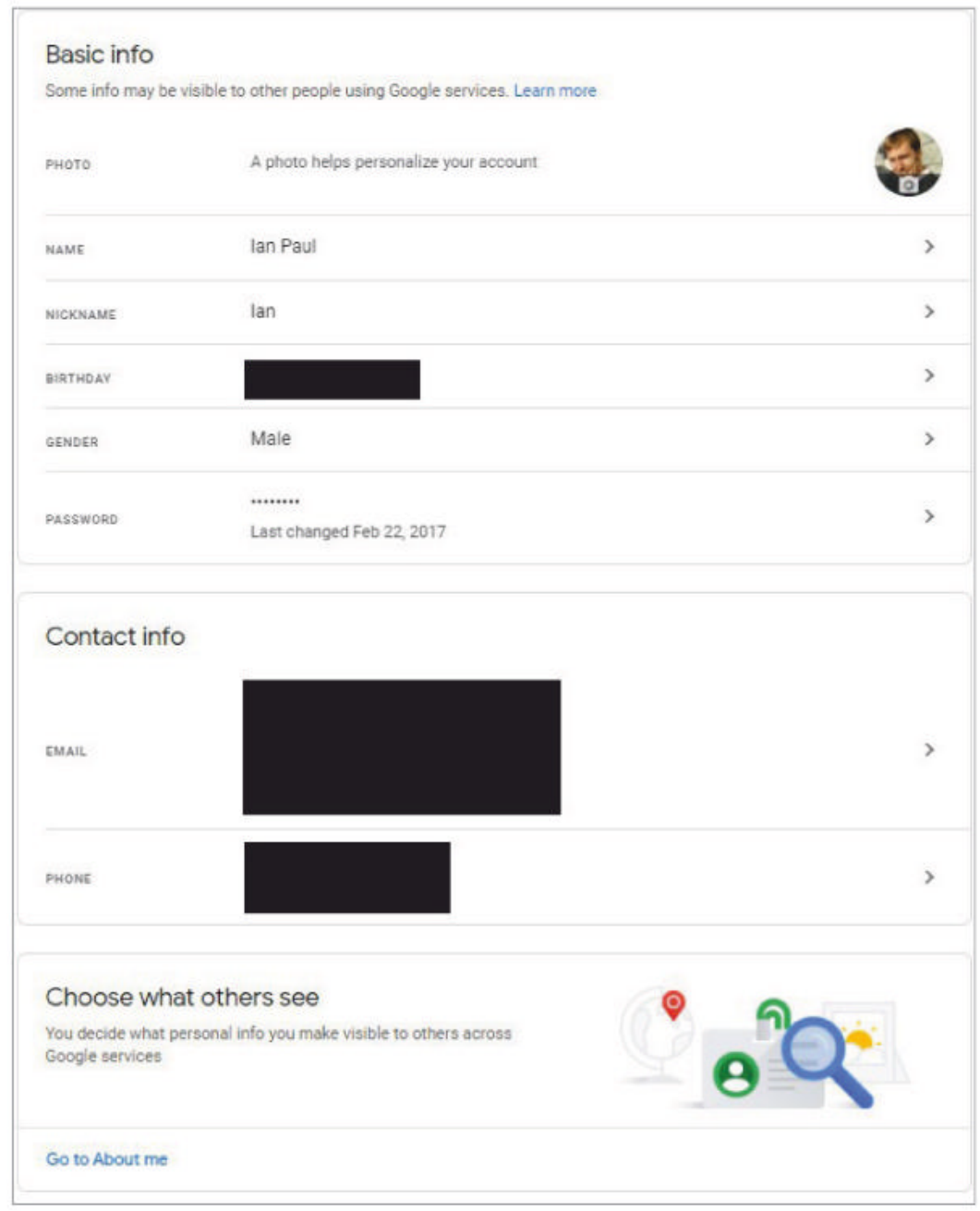
You could go through each tab, but to target our purge strategically we'll stick to the tabs at the top. We'll also be jumping around a bit to deal with the sections where the most critical personal information lies.

The easiest place to start is the Personal info tab. Here you'll see listed information such as your name, nickname (usually your first name), birthdate, gender, backup email addresses for account recovery, and phone numbers. Click anything in this section with an arrow to the right, and it will take you to a screen where you can manage this data.

Almost all of this information can be deleted, or if not it can be changed. The key bits Google insists on having include your name and nickname. If Google has your



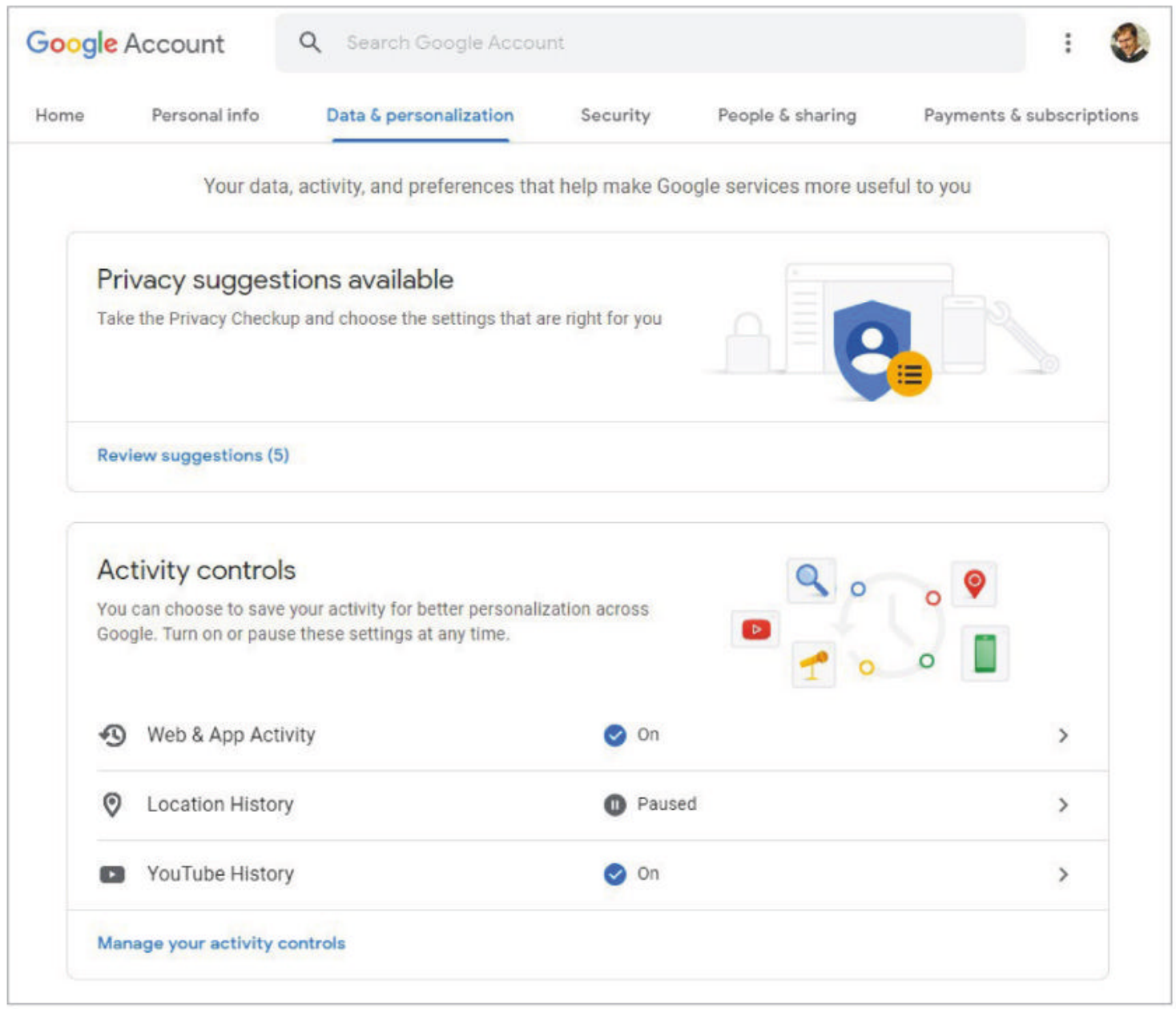
Google's My Account website is the starting point for seeing the company's stored data about you.



The Personal Info section on Google's My Account website.

birthdate, this cannot be deleted, but you can change it and restrict who is able to see it. You also cannot change or delete your alternate usernames if you have any.

Click on the link Go to About me in the "Choose what others see" tile toward the bottom of the page. Here you won't delete information, but rather you will choose who can see it across Google's services.



Google's Activity controls section is the launch point for a lot of key information.

HISTORIES

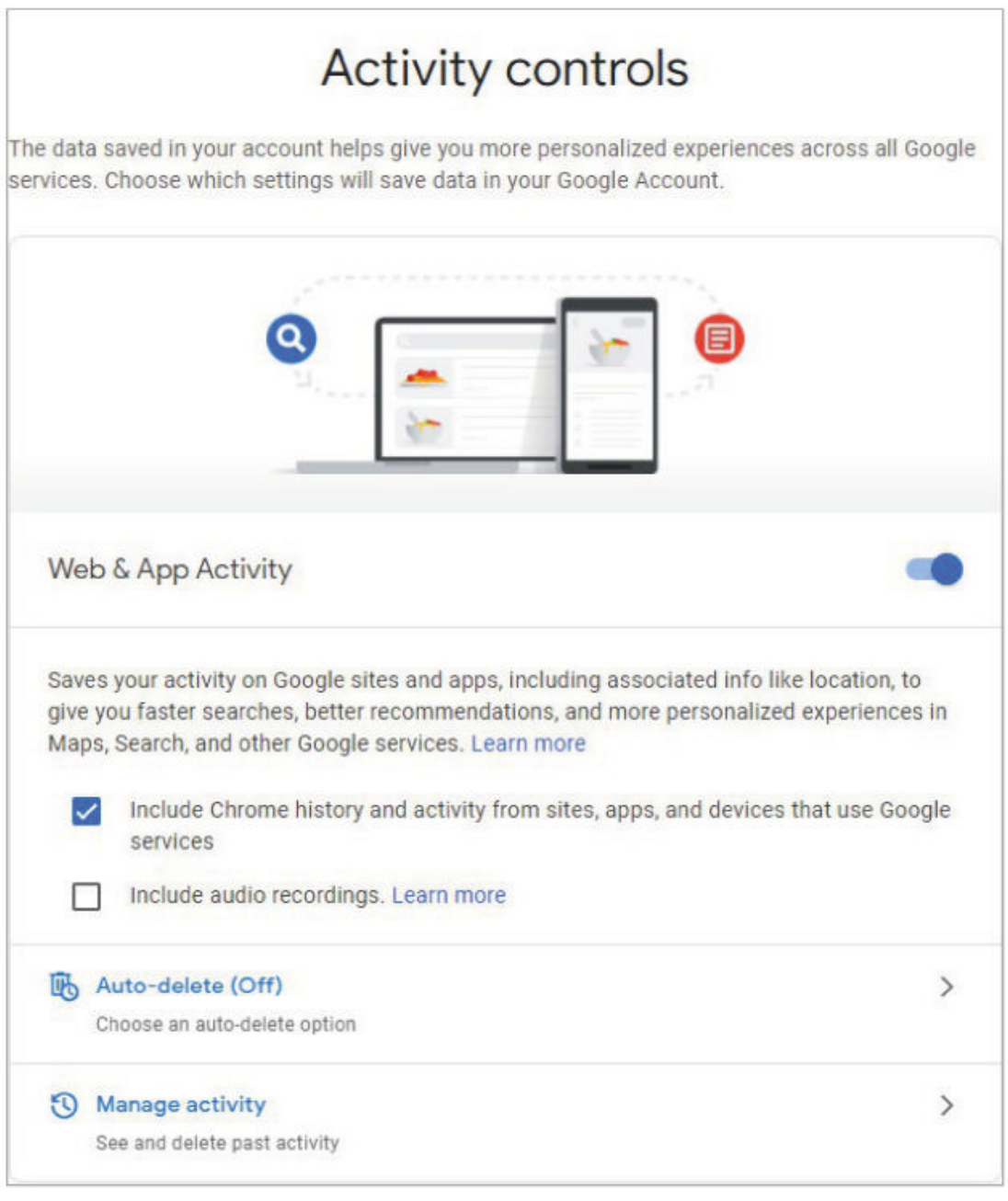
The history of your activity with Google services and products includes your browsing history from Chrome, search history, YouTube search and viewing histories, and the all-important location history (largely culled from mobile devices).

Location History is the most critical to personal privacy. Go to Data & personalization > Activity controls > Location History. On the next screen you'll see a number of options, including the ability to turn location history on and off right at the top. There's an autodelete option that you can set to jettison information older than 3 months, 18 months, or 36 months. A "manage activity" section opens Google Maps, where you can delete what information Google has on a case-by-case basis.

The next one is your browsing and search history under Data & personalization > Activity Controls > Web & App Activity. Again we get to a second page with some simplified controls. You can turn off your

Chrome history and activity on other Google services with a simple click. There's an option for not saving voice recordings, which includes all your Google Home queries as well as any other Google Assistant queries on other devices. This setting is off by default, but if you have it on and decide to turn it off again, prior recordings won't be deleted.

Below that we have another autodelete option, as well as links to Google's My Activity page (go.pcworld.com/myac), where you can delete past audio recordings, specific searches, and app usage on Android.



Google's Activity Controls make managing your data easier.

Finally, there's your YouTube histories, which includes your watch and search histories. This is found at Data & Personalization > Activity Controls > YouTube History, and it follows the same basic settings that we saw in the other two sections.

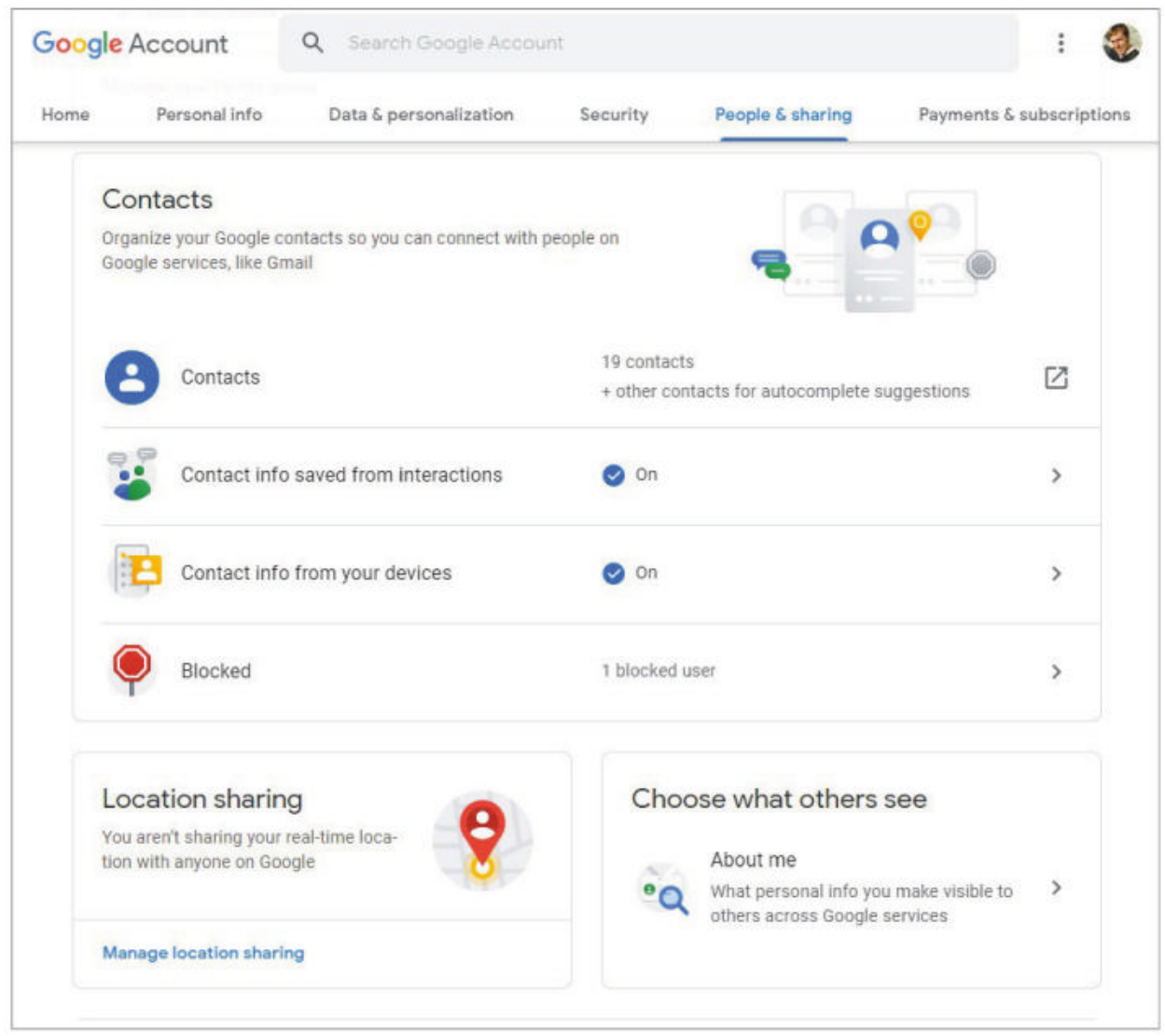
CONTACTS AND AD PERSONALIZATION

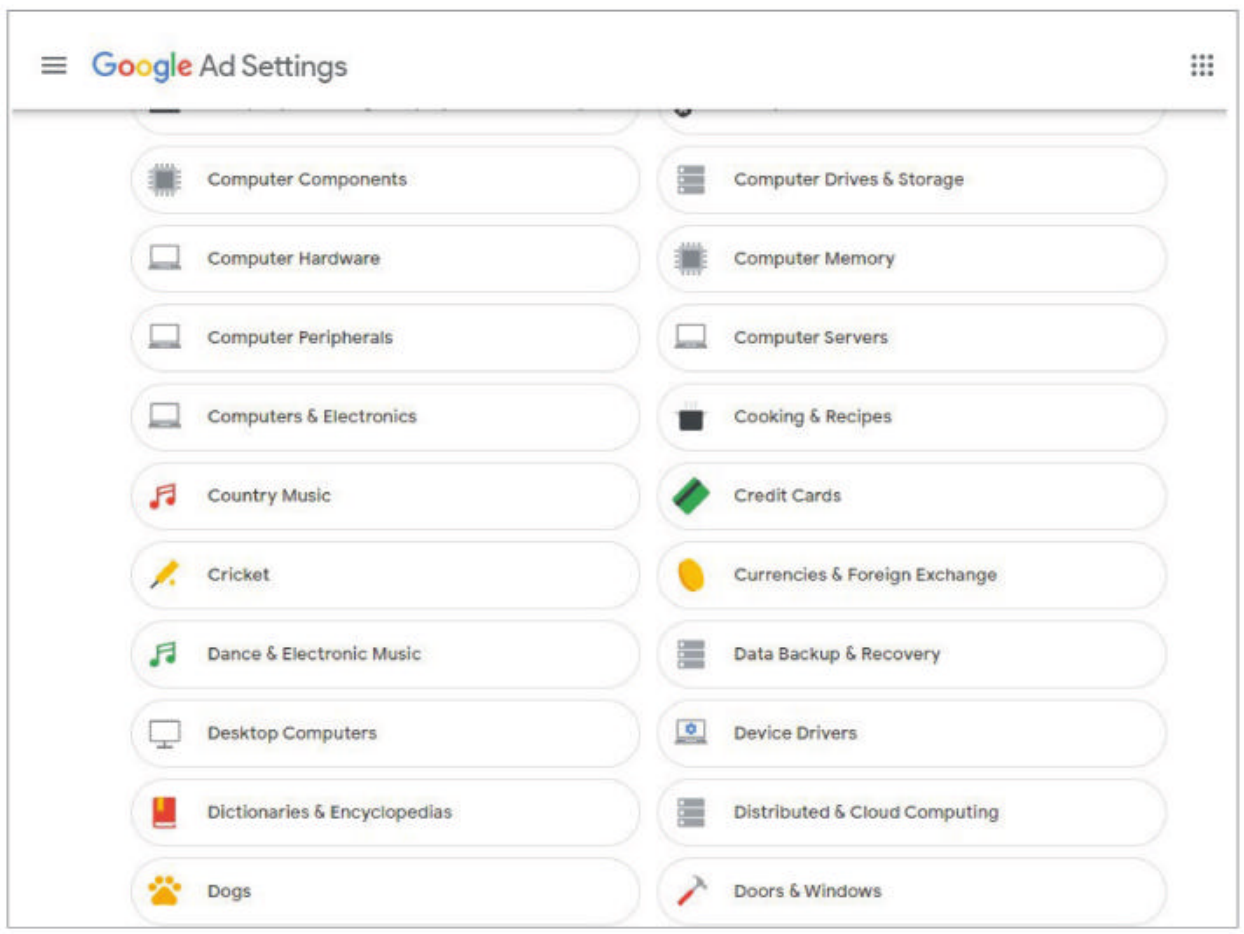
If you've decided to manage your contacts on a separate service such as your own Nextcloud (go.pcworld.com/nxcl), then you may want to get rid of your contacts on Google. You don't need to jump into Gmail to manage this—they are easily accessible via My Account at People & sharing > Contacts. Alternatively, you can just go to the dedicated Contacts site while signed into your Google account.

This section of the My Account site lets you turn on or off features such as saving contacts from your signed-in devices, like a phone. There's also a setting for saving contact information for people you interact with in Google services. This setting does not, however, apply to a similar setting in Gmail. For that, you need to go to Gmail's settings under General > Create contacts for autocomplete.

To dip into the weird world of Google data analytics, take a look at

Data & personalization > Ad personalization > Go to ad settings. This section lets you turn on and off ad personalization in Google products (based on your browsing, search history, YouTube history, and so on). Below that is an entire section that shows how your ads are personalized. This includes basic stuff like your age demographics, gender, marital status, and language. But it also has a long list of advertising subjects Google thinks you're interested in. It appears that once you search for something a few times it gets tagged in this section. If you have ad personalization turned on, you can't delete any of these categories, but you can turn them off so Google won't show you ads based on these subjects.

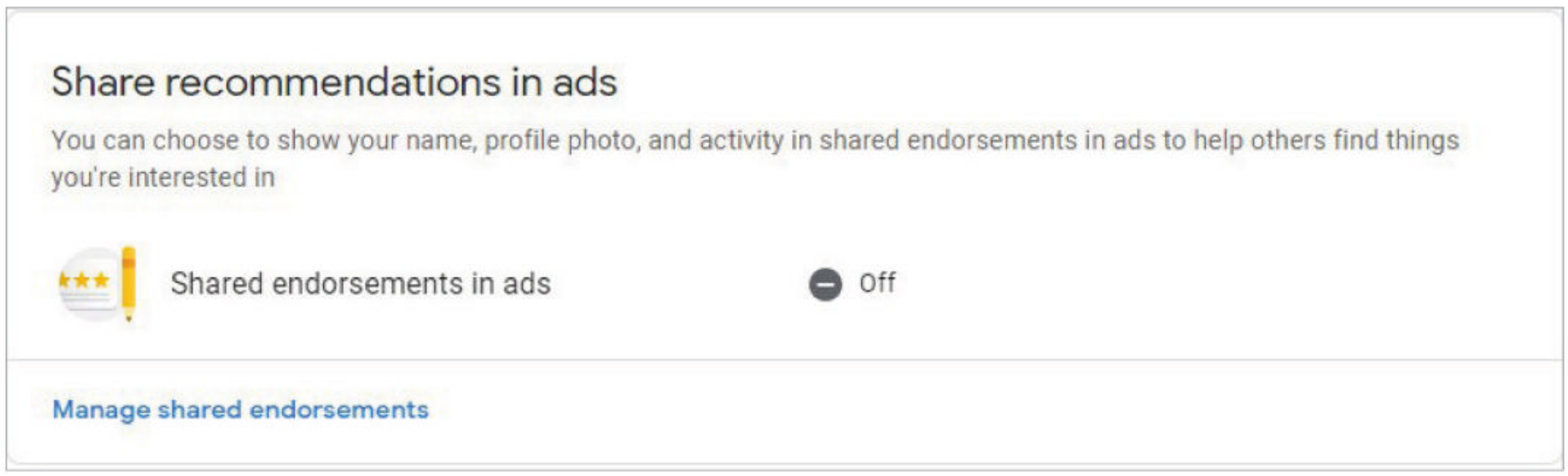




A sampling of Google's ad personalization settings.

ODDS AND ENDS

Those are the critical pieces of information Google has about you, but there's still a ton of items to uncover. One item we'd suggest everyone turn off is shared endorsements. This is a setting where your name,



"Share recommendations in ads" is an easy pick for turning off.

profile photo, and activity can be included in ads shown to people you know. This usually happens if you've reviewed a product they're looking at or something similar. Neither Google, nor any other company, needs your unwitting help to sell things. You can turn this off under People & sharing > Share recommendations in ads > Manage shared endorsements.

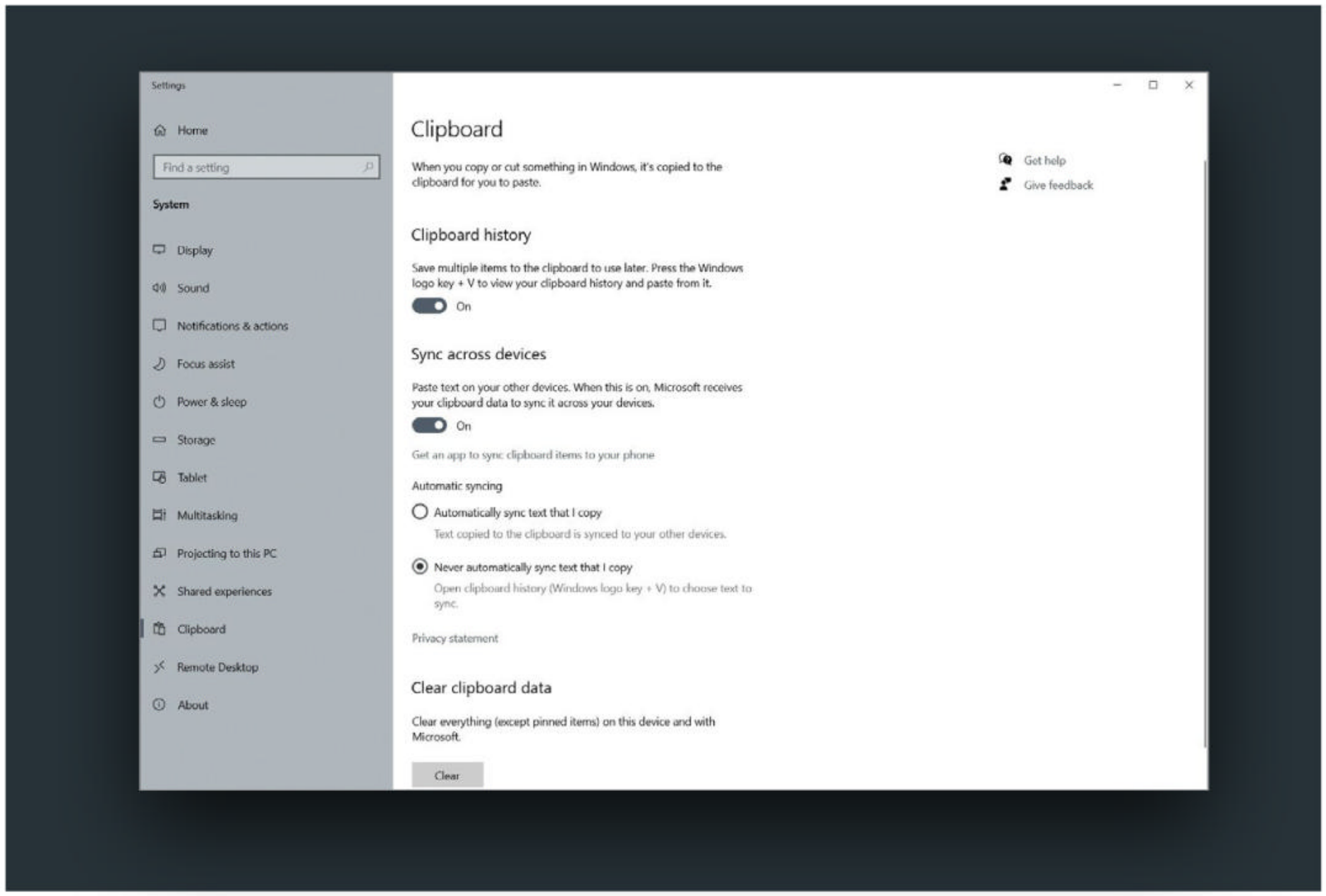
If you scroll down toward the bottom of Data & personalization, you will also find sections for managing reservations of flights, hotels, and events based on activity from search, Maps, and Google Assistant. Finally, if you scroll up a bit in this section, you'll see a tile that's titled "Download, delete, or make a plan for your data," where you can delete your account or download all of your data.

We didn't touch the Security tab, because it's mostly information that you don't want to change or that Google insists on having so you can get back into your account if you lose your password. We'd recommend you delete phone numbers once you have another method of recovery set up.

Using your phone number for SMS-based authentication to sign into your account or authorize actions is simply not secure. A better option is to use two-factor authentication like Yubikey or Google's Authenticator app. Google's homegrown one-click "Yes, it's me" authorizations on an Android phone are also better than an SMS option.

Another section we didn't discuss is Payments & subscriptions. If you no longer want Google Pay to have one of your payment methods, this is where you'd delete it. This section is also where you can manage your YouTube subscriptions and any purchases you made using search, Maps, or Google Assistant.

Google has an absolute ton of information about you, but it's mostly accessible from a single website that is easy to understand and manage. Enjoy plumbing the depths of your online persona, or at least what Google believes it is.



Windows 10's Clipboard History is the best little tool you're not using

One little Windows keyboard shortcut makes copying and pasting much more useful.

BY JARED NEWMAN

Sometimes the best software tools are built right into the operating system you're already using.

Case in point is Windows 10's Clipboard History tool, which lets you store multiple items at a time for copying and pasting. While there's no shortage of third-party clipboard managers for Windows—many of which cost money—Microsoft's own option might be all you need. It's especially handy if you are often juggling a lot of text or images and find yourself copying and pasting the same items repeatedly.

Using the Windows 10 Clipboard History tool is easy: Press Win+V, and you'll see a small pop-up prompting you to turn on the feature. From that point onward, you can press Win+V to view a running list of the last 25 text snippets

IMAGE: IDG

or images that you've copied.

To paste an older item from your Clipboard History, just click on it in the pop-up menu, and it'll insert itself wherever your cursor is located. For text, you can also hold Shift while clicking to remove any formatting, similar to how you'd press Shift-Ctrl+V to paste the most recent item in your clipboard without formatting.

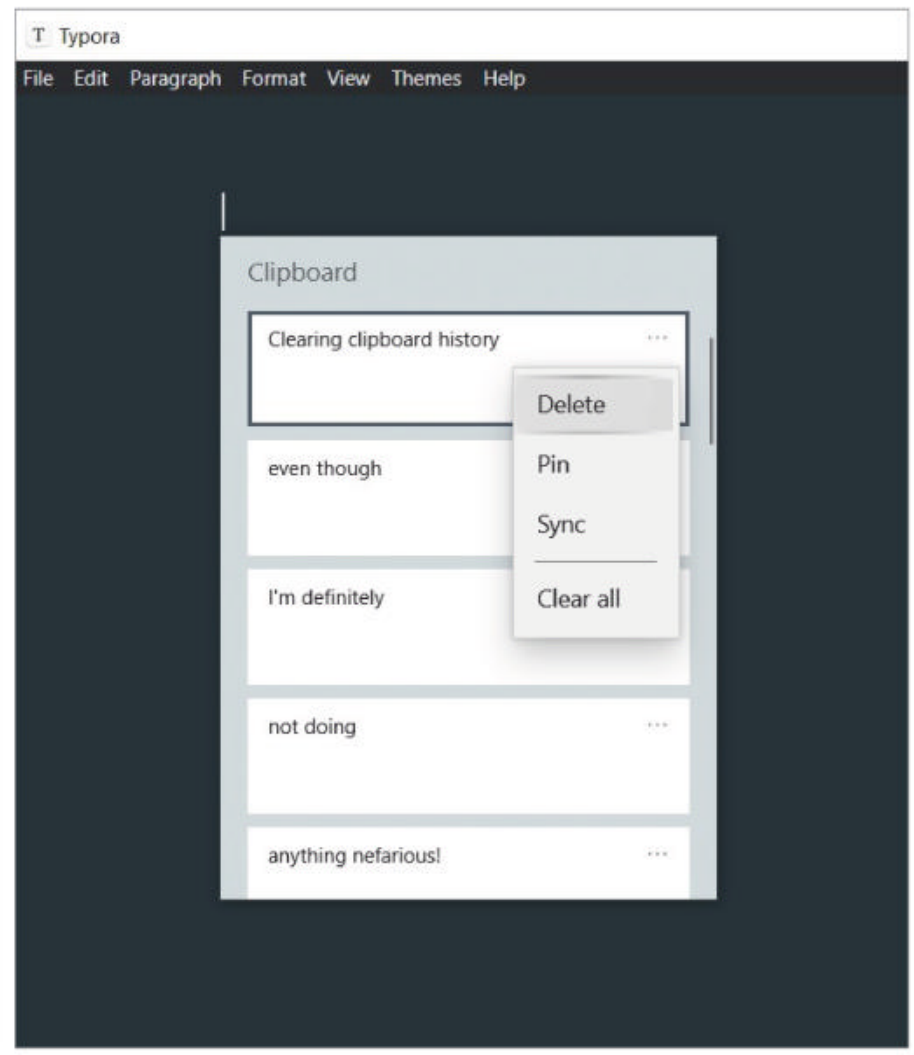
EXTRA CLIPBOARD HISTORY OPTIONS

The Windows 10 Clipboard History tool also tucks away a few extra features that you might not notice at first glance.

For items that you plan to paste repeatedly, you can pin them to the top of your list. Just open the Win+V pop-up menu, click the three-dot icon next to the item, and select Pin.

From this same menu, you'll also notice options for Delete, which wipes that individual item from your clipboard, and Clear All, which nukes your entire clipboard history. Keep these options in mind if you're copying sensitive data that you don't want other users of your computer to see.

Don't overlook Windows clipboard's cloud sync capabilities, either. Head to Settings > System > Clipboard, then enable "Sync across devices." You can then choose to either sync your entire clipboard or select items one a time. (For the latter case, you'll see a Sync option in the three-dot menu next to any item in your clipboard.)

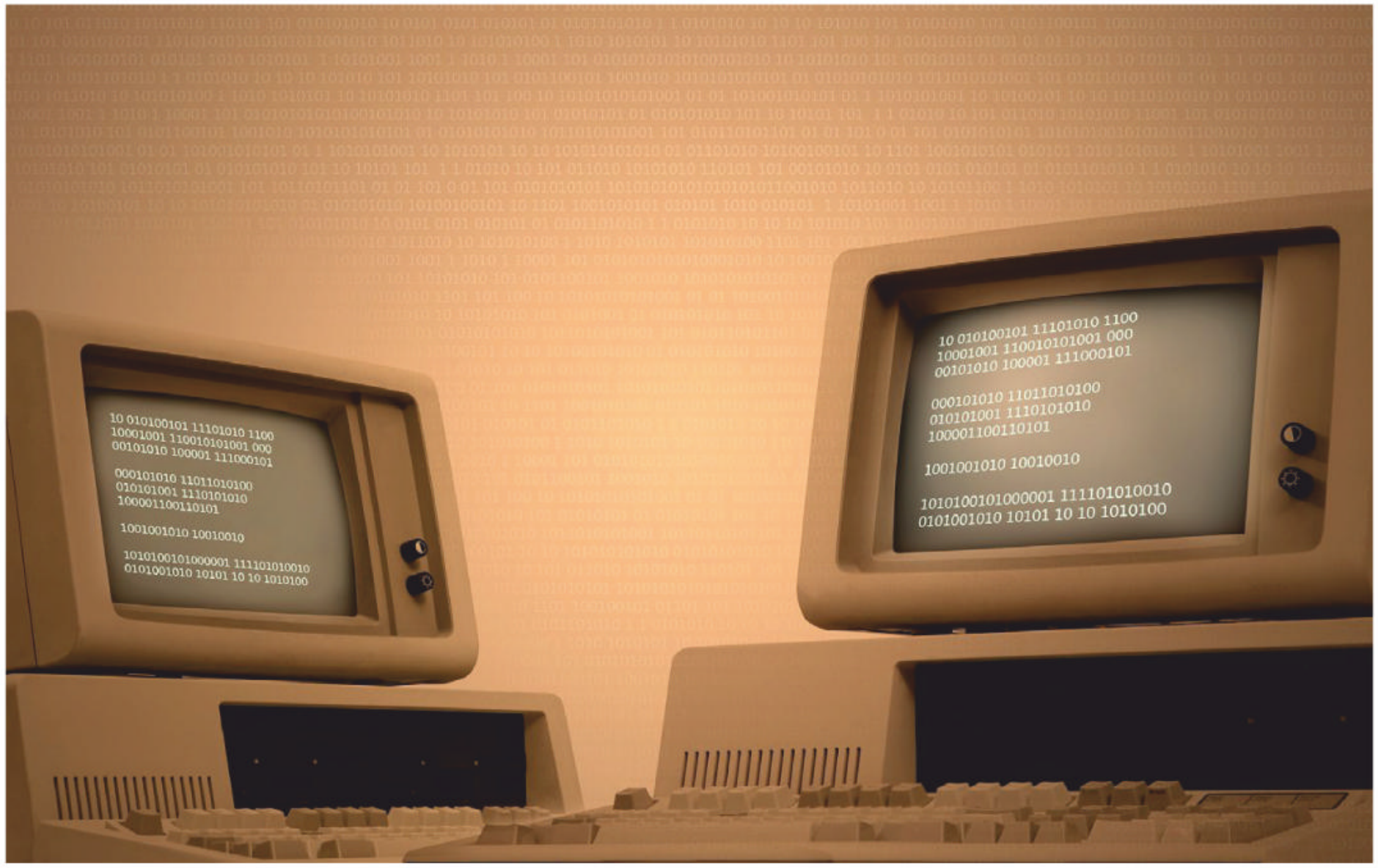


Synced clipboard items will automatically be available on other Windows 10 PCs signed into the same Microsoft account. On Android, Microsoft's Surface Duo and certain Samsung phones (go.pcworld.com/ctsm) also support clipboard sync via the Your Phone Companion app (go.pcworld.com/fncm). Of course, deleting an item from your clipboard will remove it on other devices as well, and they'll be removed automatically after 12 hours.

As with anything shortcut-related (go.pcworld.com/shrl), the biggest challenge with Windows 10's Clipboard History tool is remembering to use it in the first place. Next time your pinky's hovering over the Ctrl key to copy and paste, just keep in mind that you can hit the Win key right next to it to make your clipboard a lot more useful.

How to make an old PC useful for someone else

A couple software changes and one key hardware update is really all you need to revive an older machine. **BY ALAINA YEE**



Q: I need to set up an elderly relative with a computer for times when a smartphone doesn't cut it—printing information from websites and documents, mainly. I've got an old machine from 2007 that still works, and it'll have to do since I've been ordered not to spend "any money whatsoever" on this project. Got any tips on making this machine semi-pleasant to use? I'm willing to spend a little on hardware upgrades and lie about it later.

A: You shouldn't need to drop much cash on that machine to make it tolerable by modern standards. Despite the age of that dual-core processor and low-end discrete graphics card, the combo can handle web browsing

IMAGE: GETTY IMAGES

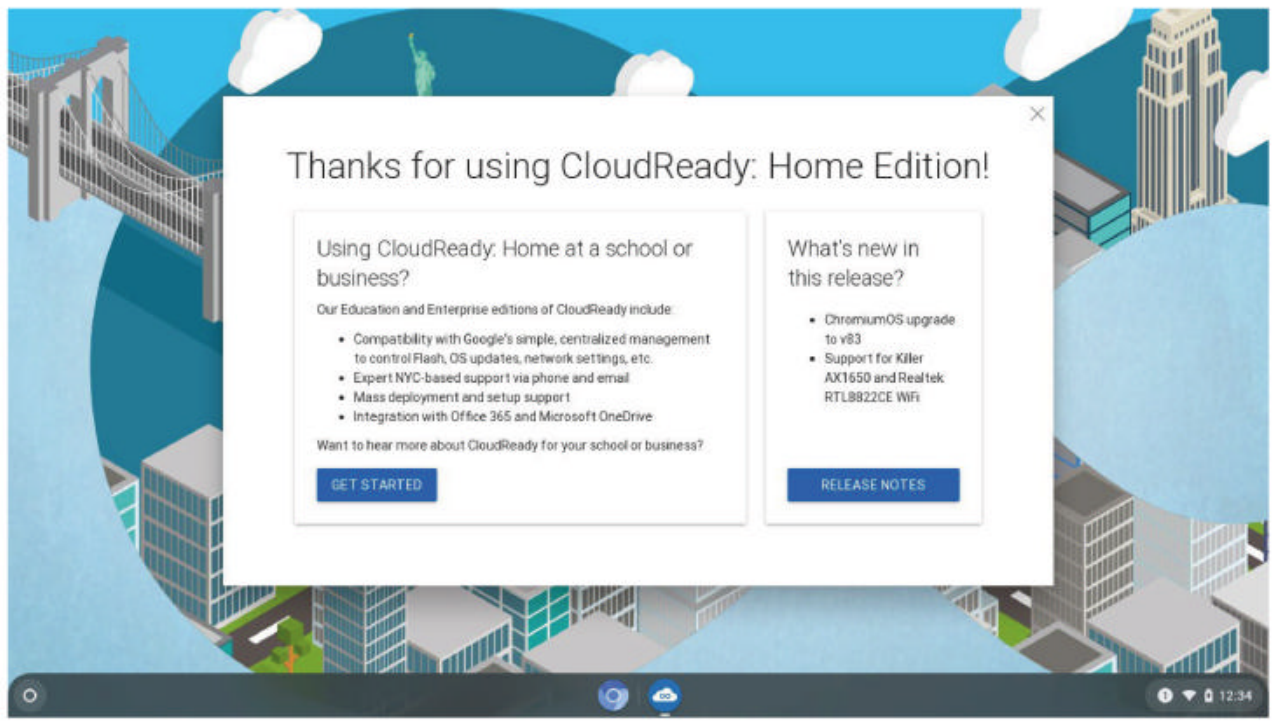
A new SSD, such as the Samsung 870 EVO, will give your computer a speed boost.

(including streaming video) and printing just fine. You also have 4GB RAM, which is a sufficient amount for light computer tasks. The one hardware update I recommend is replacing the hard-disk drive with a solid state drive—an SSD will make the computer feel much newer and snappier. These days, a name-brand 256GB SSD like the Samsung 870 EVO (go.pcworld.com/ev87) costs $40, which should be enough space for your relative's needs. (You can find more recommendations in our list of the best SSDs [go.pcworld.com/lbsd].)

While you're inside the PC, be sure to clean out (go.pcworld.com/clot) any dust build-up—you don't want obstructed airflow dragging down system performance. Also consider replacing the old thermal paste on the CPU with a fresh application if that's in your comfort zone. (If you don't know what to get, Arctic Silver 5 [go.pcworld.com/slv5] is most people's trusty fallback.)

On the software side, you can get by on entirely free programs. You mentioned that the PC currently runs Windows, but not which version. Our best guess is that it's a version already put to pasture (such as XP, Vista, or 7), so you'll need to switch to a modern operating system to keep your relative protected from security threats. The most straightforward solution is switching to Linux—you can choose one of several beginner-friendly Linux distributions or distros (go.pcworld.com/lnbg) to install. Afterward, add Chrome or Firefox for web browsing, as well as OpenOffice for opening document files created in Microsoft Office.

Worried that Linux may be too technical or unfamiliar? Convert the system into a gigantic Chromebox courtesy of Neverware's CloudReady software (go.pcworld.com/crdy). The PC will serve as a Chromebook in desktop computer form, which greatly simplifies the browsing experience. (You can read about how to install CloudReady in our "How to turn an old laptop into a

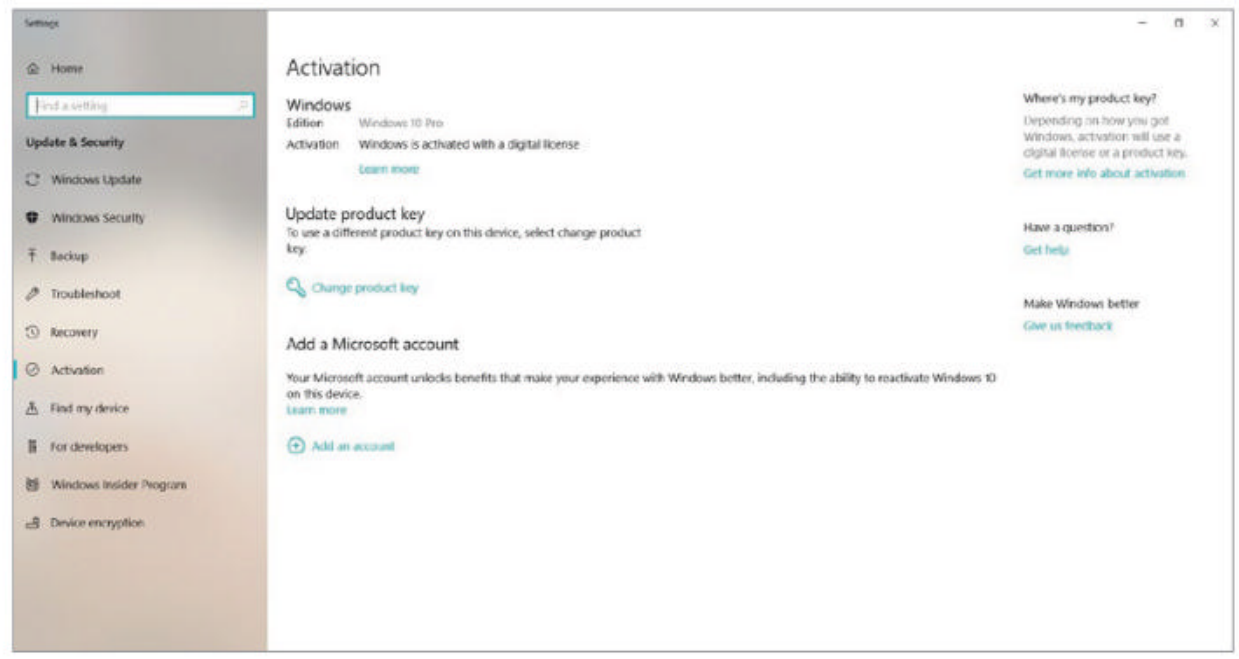


For some PC users, Chromebooks or Chromeboxes are the better balance of simplicity and functionality. CloudReady allows you to DIY one with your own hardware.

Chromebook" article [go.pcworld.com/lpch].) Your relative can view and print Microsoft Office documents through Google Docs or Sheets, as well as use those cloud-based document editors to create and edit files of their own.

The final option is that if you have a Windows 7 license (go.pcworld.com/w7li), you may still be able to convert it to a free Windows 10 license. Alternatively, if your relative happens to be taking classes at a community college, check to see if it offers free Office 365 subscriptions to students, as one of our local junior colleges does. Windows 10 will feel slower than most Linux distros (and definitely slower than CloudReady), but it's hard to argue with what may feel most familiar to the person who'll use the machine. Pair this freebie version of Win10 with Chrome or Firefox, throw on a copy of OpenOffice for dealing with Microsoft Office files, and then call it a day.

No matter which operating system you choose, be sure to keep the number of other installed programs to a minimum—don't drag down the system with unnecessary background processes. That should make it even easier to present a decent working machine to your relative without violating their orders too much—and you'll rest easy knowing they'll have a more pleasant experience.



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