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Meet ConceptD

Acer's new PCs for creators

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SMART TIPS FOR TWO-FACTOR AUTHENTICATION

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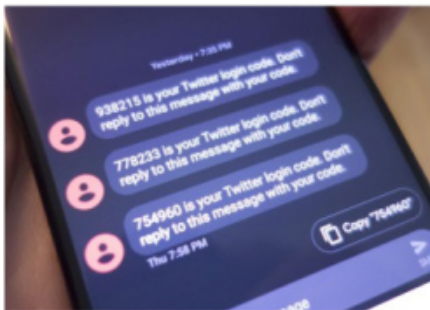
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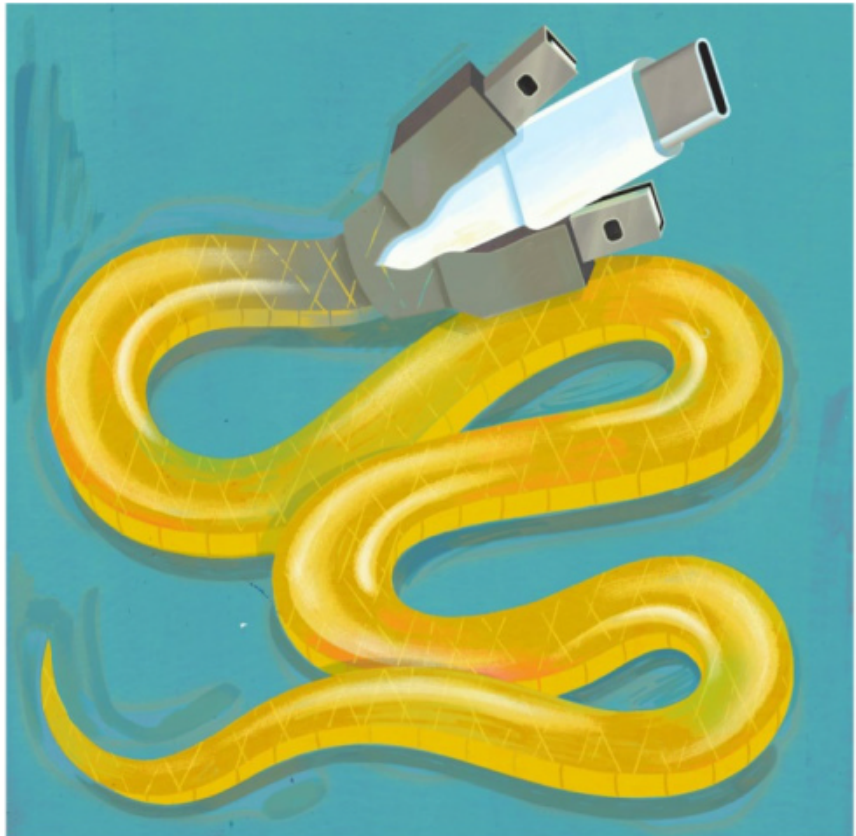


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**If you love them enough
to listen to “Hot Cross Buns”
for two hours straight,
then surely you’ll check to
make sure they’re correctly
buckled in the back seat.**

Sorry, gamers: Acer's ConceptD PCs are powerful, quiet, and cool, but made for creators

Because hot, loud gaming PCs don't play well in artsy studios. **BY MELISSA RIOFRIO**



ConceptD could be the gaming PC of your dreams, but it's not for gamers. ConceptD is Acer's new brand of PCs made for creative professionals who need gaming-class graphics power, but in quieter, cooler systems, better suited for corporate and

studio environments.

Acer introduced ConceptD at the company's next@acer event in New York. The brand's genesis came about after Acer discovered that 50 percent of its so-called "hardcore gamer" customers also used professional creative applications on their

gaming PCs.

Acer further discovered that another 15 percent of its gaming PC customers were using their systems exclusively for professional creative applications—not gaming at all. This last group simply needed the horsepower. What they didn't need were the heat, noise, and in-your-face aesthetic that come with gaming PCs.

(My take: Gamers probably would welcome cooler, quieter, PCs, but cost is surely an issue.)

IT'S A POWERFUL PC, IT'S A LIFESTYLE

With ConceptD, “we’re talking about a new lifestyle,” explained Acer CEO Jason Chen. That’s apparently one where most systems (except the most expensive ones) sport cool-white paneling and woodlike accents. Where the metal AeroBlade 3D fan previously seen on Acer’s gaming laptops works with what the company called “a noise reduction mechanism” to keep sound emissions below 40 decibels—a library level of quiet. And one where color matters: All ConceptD laptop displays will have 100-percent Adobe RGB color gamut, Pantone certification, and a Delta-E (a color differentiation measurement) of less than 1 percent.

A few ConceptD models will start shipping in April, with others coming later in the year. Here’s a rundown of the product line so far.

The flagship model is the ConceptD 9. Like the Acer Predator Triton 900 (go.pcworld.com/t900) we just saw at CES, the ConceptD9 display is mounted on an Ezel Aero Hinge—two arms that can rotate it acrobatically up and over. The ConceptD 9 has a 17.3-inch UHD (3,840 x 2,160 pixels) touchscreen display with a maximum brightness of 400 nits.

Inside, you get an Intel 9th-gen Core i9 processor and up to 16GB of DDR4 RAM, plus an Nvidia GeForce RTX 2080 GPU. A Wacom EMR Pen comes standard. The ConceptD 9 will ship in June with a



The ConceptD 9 laptop has a display that rotates on a two-armed hinge, and a Wacom EMR pen for its touchscreen.

starting price of \$4,999 (not \$4,000, as I mistakenly say in my video coverage).

CONCEPTD SEES A PC AND WANTS TO PAINT IT WHITE

The two other laptops, thin-and-lights shipping in April, include the ConceptD 7 and ConceptD 5. Both have 15.6-inch, UHD displays (without touch). The ConceptD 7, starting at \$2,299, comes with the 9th-gen Core i7 CPU, up to 16GB of RAM, and Nvidia RTX 2060 or RTX 2080.

The ConceptD 5, starting at \$1,699, pulls something special out of its hat: Intel's Core i7-8705G, a processing partnership that incorporates AMD's Radeon RX Vega M GL. It also has a fingerprint reader for security.

The two desktops will include the ConceptD 500 (available in June), which comes in white with a woodgrain-look top panel, and the ConceptD 900 (available in May), a high-performance workstation. While the 500's CPU lineup will offer options up to Intel's Core i9-9900K, the 700 offers dual Xeon Gold 6148 processors. Both will offer Nvidia Quadro RTX discrete GPUs—the 8000 for the ConceptD 700, and the 4000 for the ConceptD 500.


Note the woodgrain-like panel on top of the ConceptD 500, which brings a suggestion of nature to a highly synthetic product.

Hang onto your hats for the prices, though. While the ConceptD 500 desktop starts at a modest \$1,699, the ConceptD 700



Artsy types apparently like some woodgrain accents on their PCs, like the one on Acer's ConceptD 500 desktop.

starts at \$19,999. That's not a typo. That's the actual price for a workstation-class system with all the trimmings. Maybe that's why it's painted black, too.

Acer's serious about building out the ConceptD line. Other products will include high-resolution monitors and even a VR/AR headset. Whether creators will flock to this new brand remains to be seen. As you'll learn in my interview with CEO Jason Chen (page 10), Acer plans to bring quality and value to this specialized (and lucrative) corner of the PC world. 



**VIDEO: ACER'S CONCEPTD
PCS ARE POWERFUL,
QUIET, AND COOL**

Watch now at go.pcworld.com/cd9



Acer CEO Jason Chen explains why his PCs are going niche

Acer tries to find PC sales opportunities that competitors might miss. **BY MELISSA RIOFRIO**

Acer CEO Jason Chen thinks his company can get bigger if it thinks small. As the fourth- or fifth-largest PC vendor worldwide by shipments (per IDC and Gartner numbers, respectively), Acer already sells plenty of what it calls “value” PCs—commodity systems that offer good specs for the price. It’s thriving in the gaming and education markets, too, where performance and sturdiness matter.

Compared to PC juggernauts Dell, HP,

and Lenovo, however, Acer still has a long way to go. So the company’s next move is to pursue what Chen calls “microtrends,” courting users whose numbers might be too small—or their needs a little too niche—to draw much attention from bigger players. Acer sees an opportunity to shine by providing a more curated PC experience—a completely different strategy from its approach to mainstream PCs.

During *PCWorld*’s exclusive interview at the company’s next@acer event in New York

on April 11, Acer's CEO returned again and again to one mantra: "progress through innovation." Chen wants Acer products to break new ground rather than settle for also-ran. From his perspective, having shepherded Acer out of tougher times, the choice was to innovate or bust. In Chen's words, Acer is leaning into "innovation that excites people, gives people a good reason why they need a new PC."


The new ConceptD product line (see page 7) Chen introduced at next@acer is the company's first big example of this mantra. Aimed at creative professionals, and sporting interesting design elements as well as top-shelf hardware, Chen calls ConceptD a "lifestyle" brand. He explained that the ConceptD hardware's polished design and unusually quiet fans will make the PCs both distinctive and a true pleasure to use.

While Chen described Concept D as responding to a "microtrend," it's a movement he's committing to with more product. The CEO says the handful of laptops, desktops, monitors, and VR/AR headsets introduced last week is "just the beginning."

It'll be interesting to see where the



Acer's ConceptD 5 comes with Intel's Core i7-8705G processor, which marries quad-core CPU with AMD Radeon RX Vega M discrete graphics.

company goes with this. Acer's onto something by blazing its own trail rather than chasing the leaders. On the other hand, the only company that's successfully created an entire lifestyle around its products is Apple. That's a challenging example to follow. 

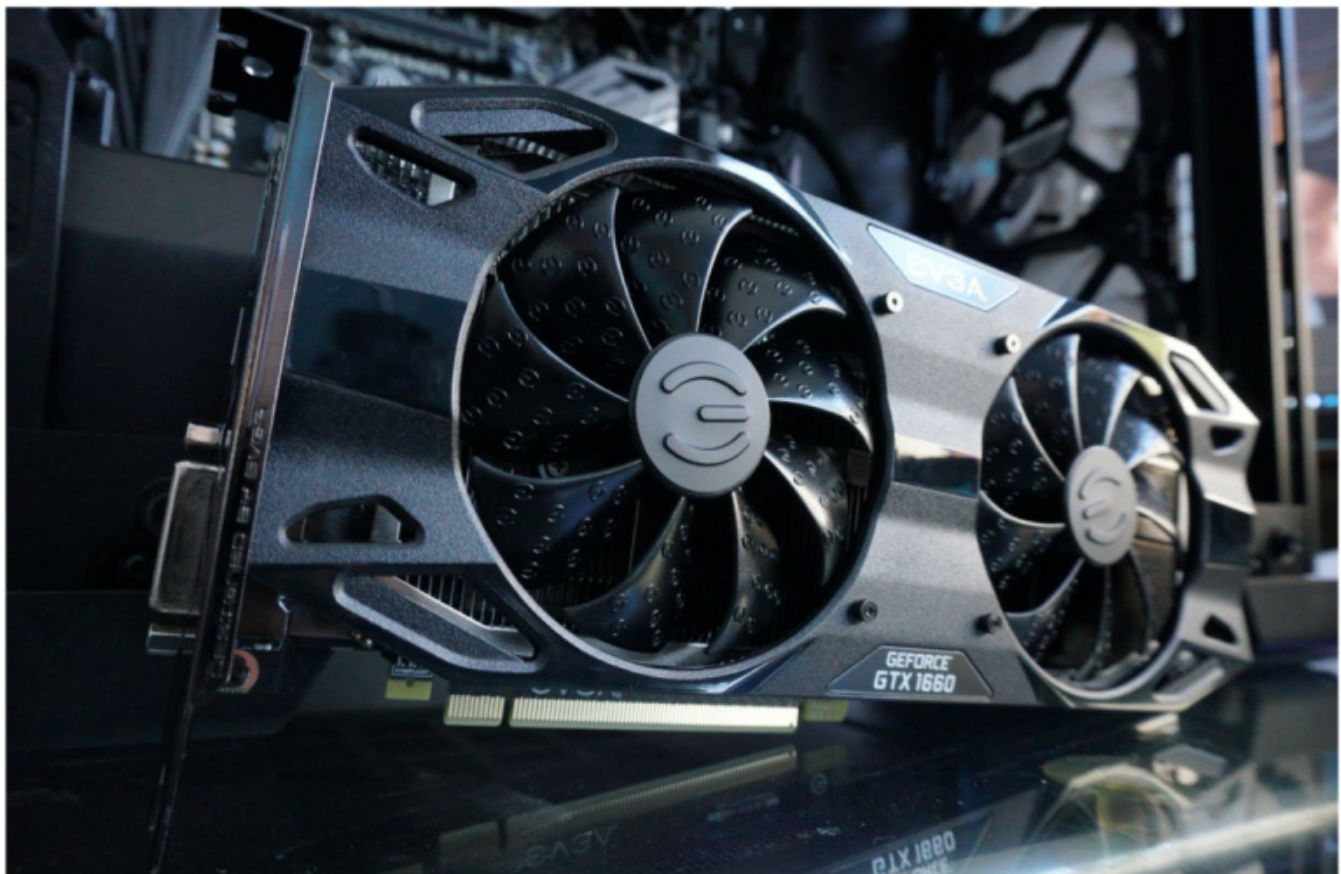


**VIDEO: ACER'S CONCEPTD
PCS ARE POWERFUL,
QUIET, AND COOL**

Watch now at go.pcworld.com/jch

RTX on GTX: Nvidia's latest driver unlocks ray tracing on GeForce GTX graphics cards

Nvidia also released three new ray-tracing tech demos. **BY BRAD CHACOS**



It was promised at GDC (go.pcworld.com/enrt), and now it's here. Nvidia recently released Game Ready drivers (go.pcworld.com/gmrd) that unlock DirectX Raytracing support on the GeForce GTX 1660 (go.pcworld.com/g160) and 1660 Ti (go.pcworld.com/16ti), and on GTX 10-series graphics cards from the 6GB GTX

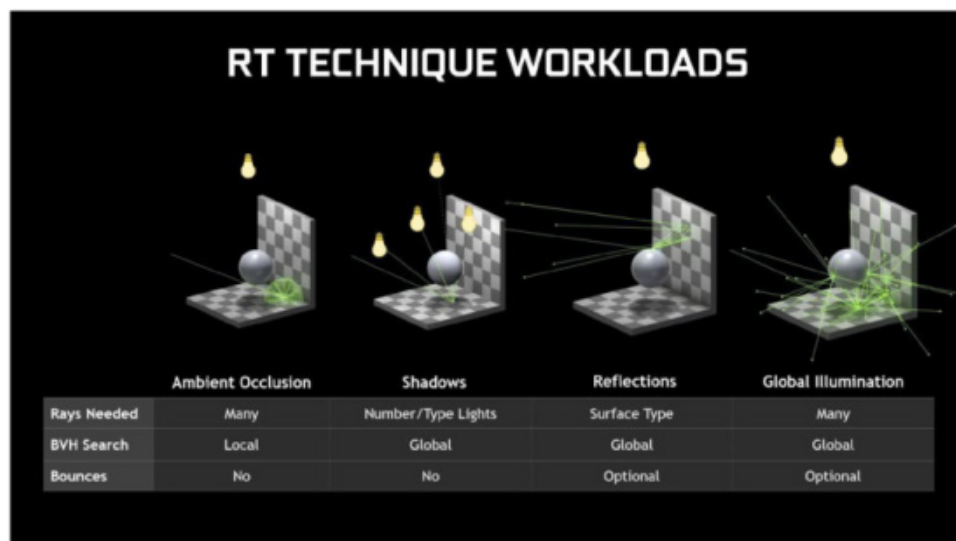
1060 on up. You read that correctly: You no longer need a pricey GeForce RTX 20-series graphics card to experience ray tracing in games that support it. Nvidia and its partners also released a trio of new tech demos that allow gamers to see the power of ray tracing for free.

If you want to experience the best

possible ray tracing, you'll still want to upgrade to an RTX graphics card. (Our guide to the best graphics cards [[go.pcworld.com/grcd](https://www.pcmag.com/roundups/best-graphics-cards)] can help you choose one.) Those GPUs feature dedicated RT cores that accelerate ray tracing, paired with dedicated tensor cores that leverage Nvidia's supercomputers to make games run faster via AI-enhanced supersampling.

While Nvidia coaxed ray tracing into working on non-RTX GPUs with this driver, the experience won't be optimal. Nvidia's blog post announcing the new Game Ready driver says it's "giving gamers a taste, albeit at lower RT quality settings and resolutions, of how ray tracing will dramatically change the way games are experienced."

Not all ray tracing is created equal. Complicated effects like Global Illumination put much more stress on graphics cards than, say, real-time reflections, and the quality level matters too. Cranking ray-tracing effects to Ultra will melt GTX GPUs much faster than Low or Medium options, which typically cast fewer rays. As such, Nvidia says GeForce GTX gamers should expect to run ray tracing at Low quality, perhaps paired with a reduction in other graphics effects, and probably at



1080p resolution. Some games with particularly intense implementations, like Metro Exodus ([go.pcworld.com/mexd](https://www.pcmag.com/roundups/best-graphics-cards)), might not hit playable frame rates on GTX GPUs if you enable ray tracing.

Still, if you want to see ray tracing with your own eyes, even a low-quality implementation is better than no ray tracing whatsoever, provided the game runs well enough to play.

But we don't have a firm grasp on how well GTX graphics cards will run ray tracing workloads at playable settings yet. Nvidia provided journalists with performance graphs for a handful of games, but they were run at 1440p resolution with ray tracing settings at Ultra to allow the full range of DXR-compatible GeForce cards to be tested, from the GTX 1060 to the fearsome RTX 2080 Ti ([go.pcworld.com/208t](https://www.pcmag.com/roundups/best-graphics-cards)). (The performance-boosting Deep Learning Super Sampling [DLSS] feature, represented by the darker

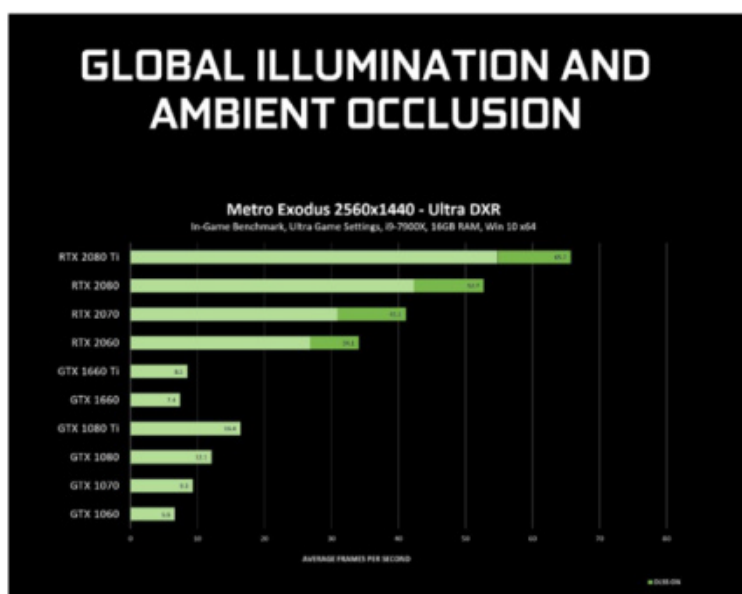
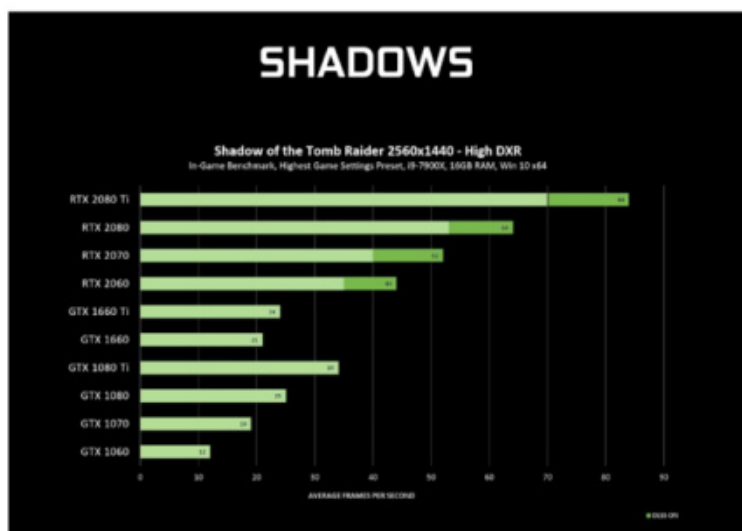
green portion in the results for RTX GPUs below, only runs at specific resolutions on specific cards, depending on the game.)

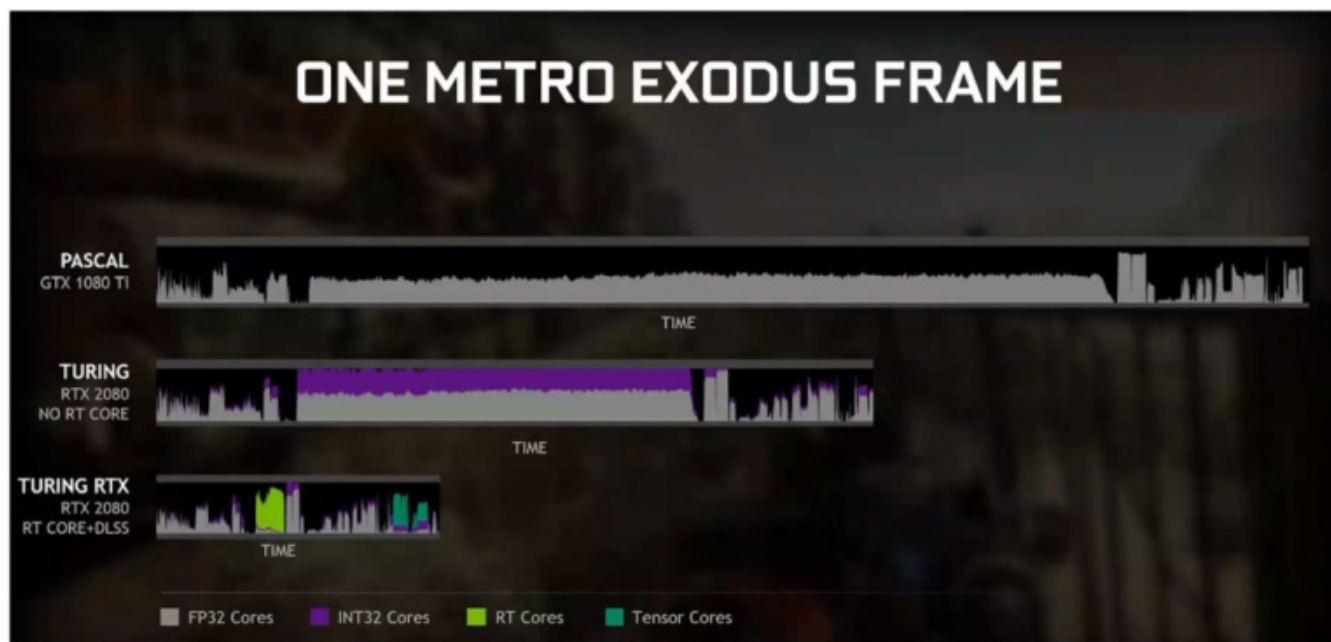
As you can see from the results, GTX GPUs simply don't play well under those conditions. We'll need to test these games at far lower visual settings and 1080p resolution.

Nvidia's graphs (right) provide some insight even if they aren't realistic use-case scenarios for GTX gamers hoping to get a taste of ray tracing.

With the exception of Metro Exodus's intense Global Illumination, the newer GeForce RTX 1660 and 1660 Ti deliver roughly as much performance as Nvidia's older GTX 1080 flagship with ray tracing enabled. GeForce product manager Justin Walker says that's because the modern Turing architecture ([go.pcworld.com/mdtr](https://www.pcworld.com/mdtr)) implements concurrent execution, which allows floating point and non-floating point instructions to run simultaneously. That processes ray-tracing tasks more efficiently. The Pascal GPUs in the older GTX 10-series cards lack the ability and need to run all instructions in a single, long queue.

Your mileage may vary depending on which GeForce GTX graphics card you're using, in other words. Download the new driver, give ray-traced games a






How Nvidia's various GPU architectures process ray-tracing frames.

whirl, and see how well your card does!

Battlefield V, Shadow of the Tomb Raider, and Metro Exodus currently support real-time ray tracing. If you don't have any of those games, Nvidia is also releasing a trio of tech demos that show off RTX's chops. You'll find demos for Justice, Atomic Heart, and that awesome Star Wars Reflections scene

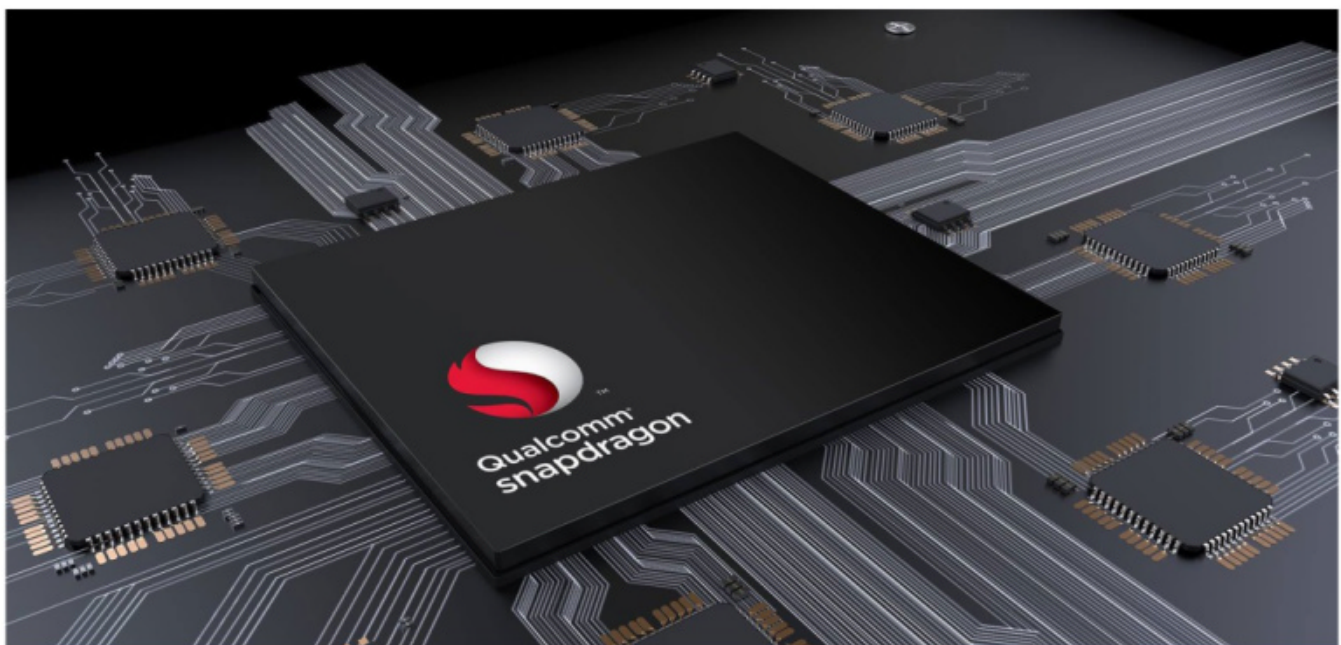
available on Nvidia's RTX 20-series landing page (go.pcworld.com/20sr). Be warned: All three leverage multiple ray-tracing techniques, and Nvidia's numbers show them chugging hard on GTX graphics cards using the same strenuous settings mentioned above.

If you're a GTX graphics card owner with a taste for trying ray tracing, an adaptive sync monitor should help significantly (go.pcworld.com/gsvf). GeForce graphics cards work with Nvidia's G-Sync monitors, and as of earlier this year, AMD FreeSync displays as well (go.pcworld.com/frsn). 



Qualcomm's Snapdragon 730G processor was built for kick-ass mobile gaming

No phones have been announced with the Snapdragon 730 or 730G. **BY MARK HACHMAN**



While Qualcomm has integrated several gaming-specific technologies into its Snapdragon mobile processors, the company recently announced something a little different: a version of its Snapdragon 730 optimized for gaming, dubbed the Snapdragon 730G.

Though mobile gaming may be an idle pastime with American consumers, it's a way of life overseas. Over 586 million mobile gamers are in China alone—twice the population of the United States, according to

Qualcomm's Hiren Bhinde at Qualcomm's technology summit (go.pcworld.com/qs85) last December. It isn't clear which phones and mobile devices Qualcomm has in mind for the Snapdragon 730G, but recent gaming phones from Asus ROG (go.pcworld.com/arev) and Razer (go.pcworld.com/rzp2) indicate that Qualcomm was designing for what they hope will be a trend.

Though most premium smartphones use Qualcomm's 8-series CPUs like the Snapdragon 855 (go.pcworld.com/sn85), the new 7-series chips are designed for a slightly

cheaper but still premium phone. Both the new Snapdragon 730 and Snapdragon 730G are nearly identical, according to specifications provided to *PCWorld*. The difference is that the Snapdragon 730G overclocks the integrated Adreno 618 GPU, providing up to 15 percent faster GPU rendering.

SNAPDRAGON 730/730G BASIC SPECS:

- 64-bit Kryo 470 (8 cores) at up to 2.2GHz
- Adreno 618 GPU
- Spectra 350 image processor
- Hexagon 688 AI Tensor Accelerator DSP with Qualcomm's Vector eXtensions

Qualcomm organized its Snapdragon 730 and 730G with two "big" performance cores and six "little" energy-saving cores, versus the four-by-four split with the Snapdragon 855. As with other Snapdragon chips, the 730/730G consists of a Kryo CPU and Adreno GPU, a dedicated Spectra image processor for the smartphone's camera, plus the Hexagon DSP that's optimized for AI capabilities. Inside there's the Snapdragon X15 LTE modem, with support for Wi-Fi 6. (Again, the 730 and 730G are essentially identical, save for an overclocked GPU on the 730G.)


Qualcomm claims that the Snapdragon 730G offers 25 percent more graphics performance than the Snapdragon 710, and 35 percent more CPU performance. It's also the first 7-series chip to offer "HDR gaming". The problem with this last claim is that the

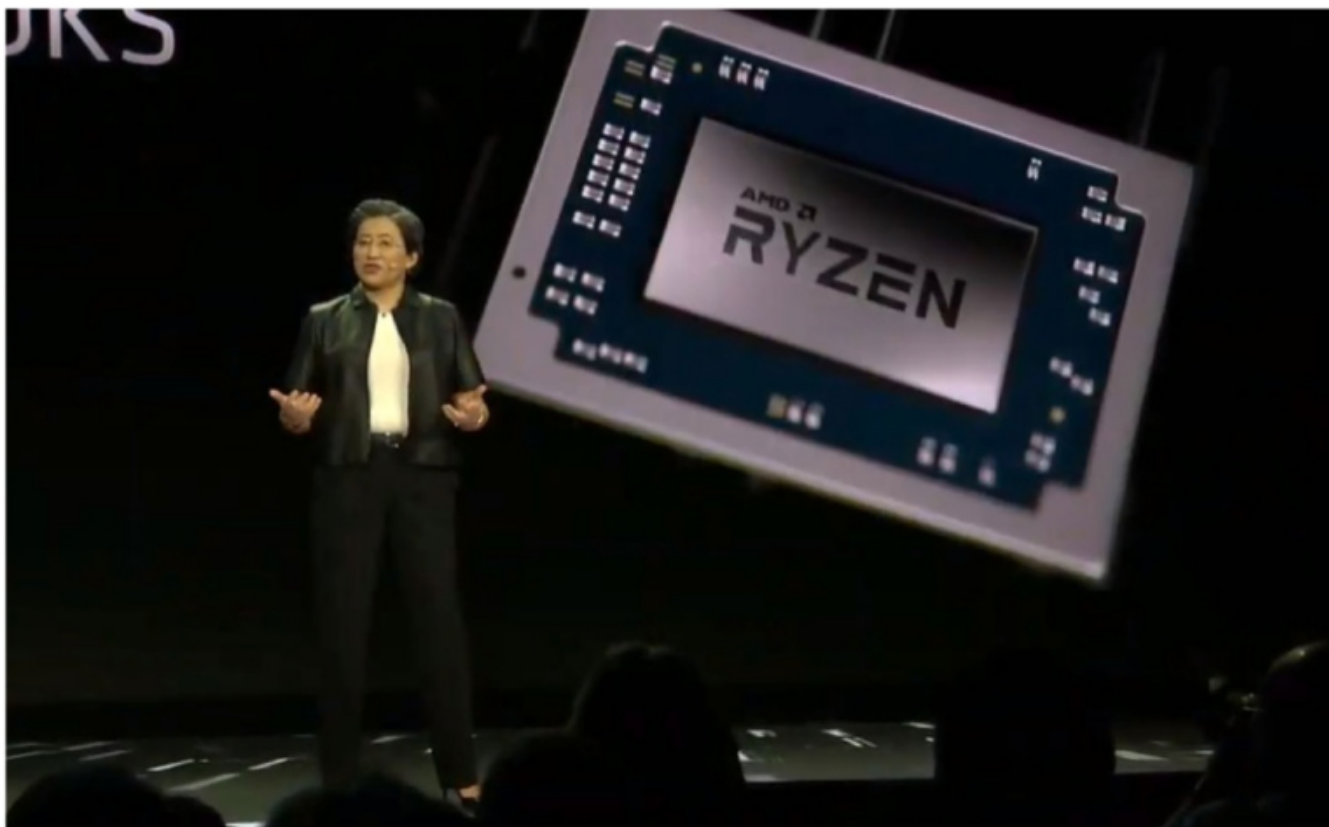
Snapdragon 710 only appeared in a handful of midrange phones from companies like Xiaomi—a huge brand in China, but one with almost no presence within the United States.

Other gaming-specific features include support for the Vulkan 1.1 gaming library, which Qualcomm says can run off 20 percent less power than OpenGL ES. The chip also includes what Qualcomm calls "Jank Reducer," a motion smoothing technology that helps avoid stutter for games running at 30 frames per second. The Snapdragon 730G also include a Wi-Fi latency manager to help smooth choppy wireless connections, too.

Qualcomm also said it worked with some of the world's top mobile game makers to optimize the chip for those games, and integrated "anti-cheating extensions" to level the playing field, too.

Qualcomm's 730 and 730G platform integrates the Spectra 350 DSP, Qualcomm's first computer-vision image-signal processing chip to appear in a 7-series Snapdragon. The ISP supports up to three cameras for ultra-wide, telephoto and normal lenses, as well as the ability to compute bokeh, even within 4K video. Users will also be able to command the phone using Qualcomm's 4th-generation AI engine, the Hexagon 688.

Machine learning, in fact, was the focus of Qualcomm's launch event, where the company debuted an accelerator for bringing cloud-powered AI capabilities closer to the edge, called the Cloud AI 700 accelerator. 



AMD's 2nd-gen Ryzen Pro mobile chips see some traction with HP, Lenovo design wins

An Intel Core or the new 2nd-gen Ryzen Pro chips? Your choice. **BY MARK HACHMAN**

One of the complaints surrounding AMD's efforts to ship mobile Ryzen chips for notebook PCs was a fundamental one: Where were the notebooks (go.pcworld.com/whnb)? In early April, AMD answered. The company announced the second-gen Ryzen Pro mobile processor for commercial notebook PCs, which will appear

first in notebooks from HP and Lenovo.

There are three new Ryzen Pro chips: the 2.3GHz, 4-core/8-thread Ryzen 7 Pro 3700U; the 2.1GHz 4-core/8-thread Ryzen 5 Pro 3500U; and the 2.1GHz 4-core/4-thread Ryzen 3 Pro 3300U. All are 15W parts, meaning that they're aimed at more mainstream and ultrathin notebooks. They all use the older 12-nm manufacturing process, but they boast the

	AMD RYZEN 7 PRO 3700U	AMD RYZEN 5 PRO 3500U	AMD RYZEN 3 PRO 3300U	AMD ATHLON PRO 300U
Cores/Threads	4C/8T	4C/8T	4C/4T	2C/4T
TDP	15W	15W	15W	15W
Boost/Base Freq	4.0/2.3 GHz	3.7/2.1 GHz	3.5/2.1 GHz	3.3/2.4 GHz
Radeon Graphics	Vega	Vega	Vega	Vega
GPU Cores	10	8	6	3
Max GPU Freq	1400 MHz	1200 MHz	1200 MHz	1000 MHz
L2+L3 Cache	6 MB	6 MB	6 MB	5 MB

discrete-class integrated “Vega” GPU that other mobile Ryzen chips do as well.

AMD claims the new processors will enable up to 10 hours of battery life, as measured by video playback, and will offer performance improvements over Intel’s Kaby-Lake R 8250U. Specifically, AMD said its Ryzen 5 3500U was 24 percent faster in Cinebench than the 8250U, and 227 percent faster in 3DMark’s Time Spy benchmark.


HP and Lenovo haven’t said what systems will ship with the new chips, only that they’ll be available this quarter. Other PC makers are expected to support the new chips later in 2019, AMD said.

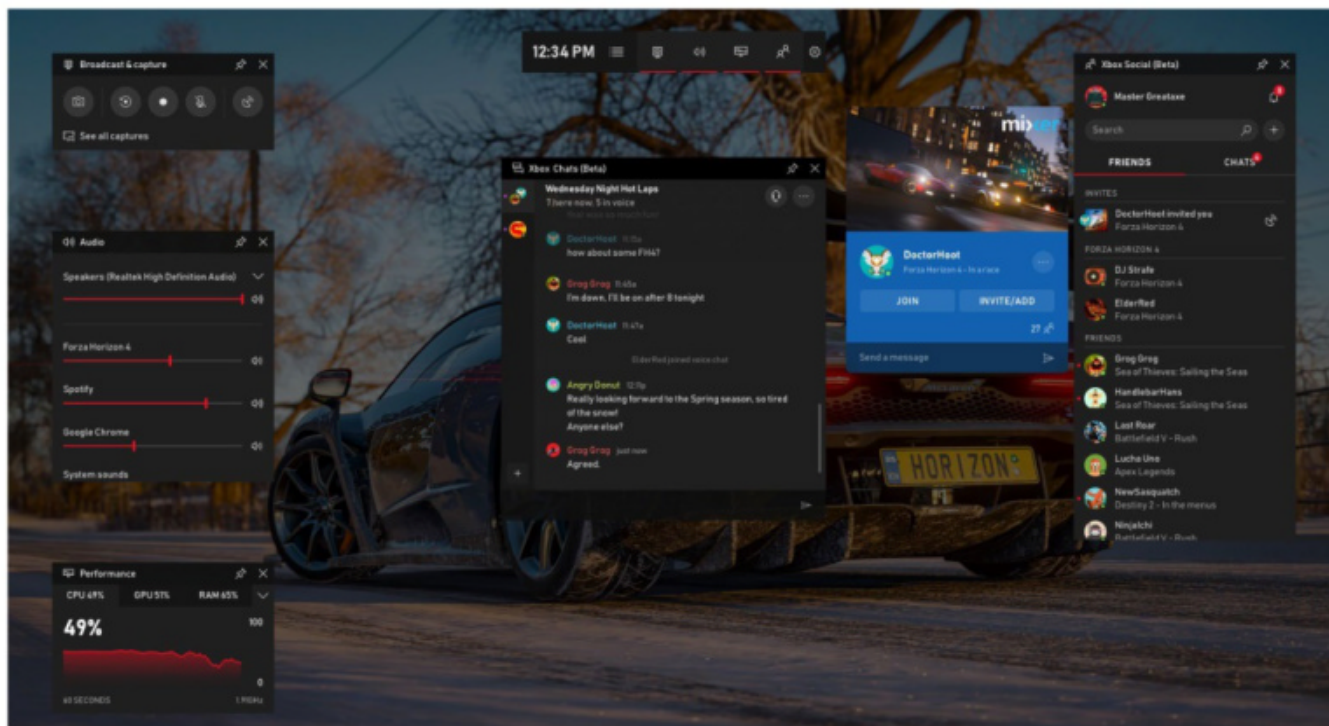
At CES in Las Vegas in January, AMD chief executive Lisa Su was asked about the relative lack of AMD-powered notebooks. Su’s response suggested a lackluster initial showing: “I would say that the first-generation Ryzen notebooks were good, some of them

were very good.”

Su continued with the promise of better things to come, saying one PC OEM planned to “triple” its designs. “It’s a journey,” as she described it: “We gained notebook share in the fourth quarter, and I think second-gen Ryzen is better than first, and third-generation Ryzen mobile will be better than second.”

AMD’s announcement comes as the debut of Intel’s 9th-gen “H” series Core chips are expected soon (go.pcworld.com/9gnh).

What this means to you: For years, AMD has struggled to keep up with Intel in the mobile processor space, in part because performance lagged. Now, with more aggressive mobile Ryzen designs, AMD’s ready to try again. The endorsements of HP and Lenovo are significant, though it’s unclear how many different models will actually feature AMD’s new Ryzen Pro chips. 



Microsoft powers up Windows 10's Game Bar with truly useful tools for PC enthusiasts

Performance tracking, Spotify integration, better volume management tools, and cross-platform chat are available to Windows Insiders starting now. **BY HAYDEN DINGMAN**

Aside from bringing its Xbox games over to the PC, Game Bar is arguably the best gesture Microsoft's made to Windows 10 gamers. It adds a tiny bit of console-esque simplicity to the PC, letting you take screenshots, record video, or stream games with simple system-level shortcuts. But...I never use it. It's my third-tier preference for screenshots and video,

after the tools built into Steam and Nvidia's Shadowplay.

Microsoft's looking to move up in the world though, and it's doing so by adding a lot more functionality to Game Bar over the next few months—most of it unique to Game Bar, i.e., not duplicated by Steam or Shadowplay. In fact, Game Bar isn't really a fitting name anymore. Game Overlay might be more appropriate, albeit less elegant.

SWISS ARMY KNIFE

Windows Xbox Insiders now have access to a new and expanded Game Bar. And the foundation of this new Game Bar? A fully customizable interface. As I said, it's more an overlay than a bar at this point, a translucent window where you can add various widgets—or pin them, so they're still visible while you play.

[UPDATE: Turns out it's even easier to get access than I thought. This new Game Bar falls under the Xbox Insiders program and not Windows Insiders. You can get access right now by grabbing the Xbox Insider Hub from the Windows 10 Store, click on Insider Content, and look for Windows Gaming. That should get you set up with the new Game Bar. If you're not seeing the Windows Gaming option, you might need to check and make sure you're running the latest version of Windows.]

Perhaps most interesting to the power users: A performance widget. Oddly enough, this one's not highlighted in Microsoft's blog post which may mean it's not ready yet. It's prominently featured in one of the screenshots they sent over though so...yeah. Anyway, you'll be able to track your CPU, GPU, and RAM usage through the new overlay, negating the need to run a third-party program to do the same. I'd love to see temperature tracking in a future update as well, but nothing on that yet.

There's also a new Audio widget, with

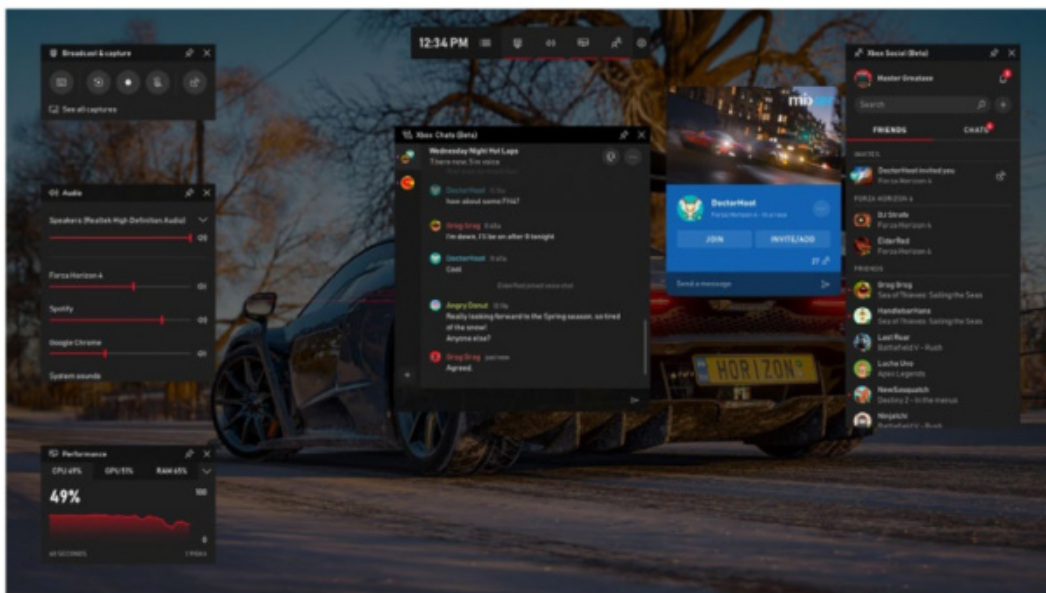
which you'll be able to not only adjust your overall system volume but also the volume of every individual program running on your PC. I'm constantly multitasking, playing games while watching Netflix or listening to Spotify or whatever, and adjusting individual program volumes at the moment means hitting the Windows key, right-clicking the volume icon, and opening the Volume Mixer, and then adjusting sliders in an interface that hasn't changed since Windows XP. The new Game Bar version looks sleek, and I'm excited to be able to dip Netflix's volume on command.

Speaking of, full Spotify integration is being added to the Game Bar as well. That widget will require a third-party login, according to the blog post, but afterward you'll be able to control your music without Alt-Tabbing away from your game—particularly helpful in games where Alt-Tab support is questionable.

Microsoft's biggest play is chat-related though. They kind of bury that section at the bottom of the blog post, and when we spoke with the Game Bar team recently they didn't make too big a deal out of it either.

But it's a big deal.

Or rather, it has the potential to be a big deal. See, Microsoft's finally integrating more of its Xbox Live social functions into Windows 10. At the moment, your Xbox Live friends are siloed off in the Xbox app, which chances are you never open unless Microsoft forces you to.



The new Game Bar has an Xbox Social widget, though, that shows you all your Xbox Live friends and what games they're playing. If you haven't opened the Xbox app recently, you're probably unaware that it works whether you're playing a Microsoft game or not—indeed, the screenshot shows people playing *Apex Legends* and *Battlefield V*, both EA games.

It looks a lot like, well, Discord. And sure enough, Microsoft also touts that chat now works within the Game Bar as well. "The same friends list and communication features work on Xbox One as well as within the Xbox App on iOS, Android, and of course Windows 10," says the blog post. It's not just text chat, either. Voice chat works as well, meaning you could (if I'm understanding correctly) be playing one game on PC and your friend playing a different game on their Xbox, but voice chatting cross-platform through the Game Bar.


That's pretty amazing to me, as someone

who lived through the "Every console is a walled garden and we must protect it from intruders" era. With Microsoft getting behind cross-play, cross-chat, all these platform-agnostic

initiatives, it really feels like the walls are finally crumbling, to the benefit of all. I'm not sure the ever-suspicious PC gaming crowd will trust Microsoft to facilitate chat over better-established and better-trusted PC clients, but it's still exciting to watch unfold.

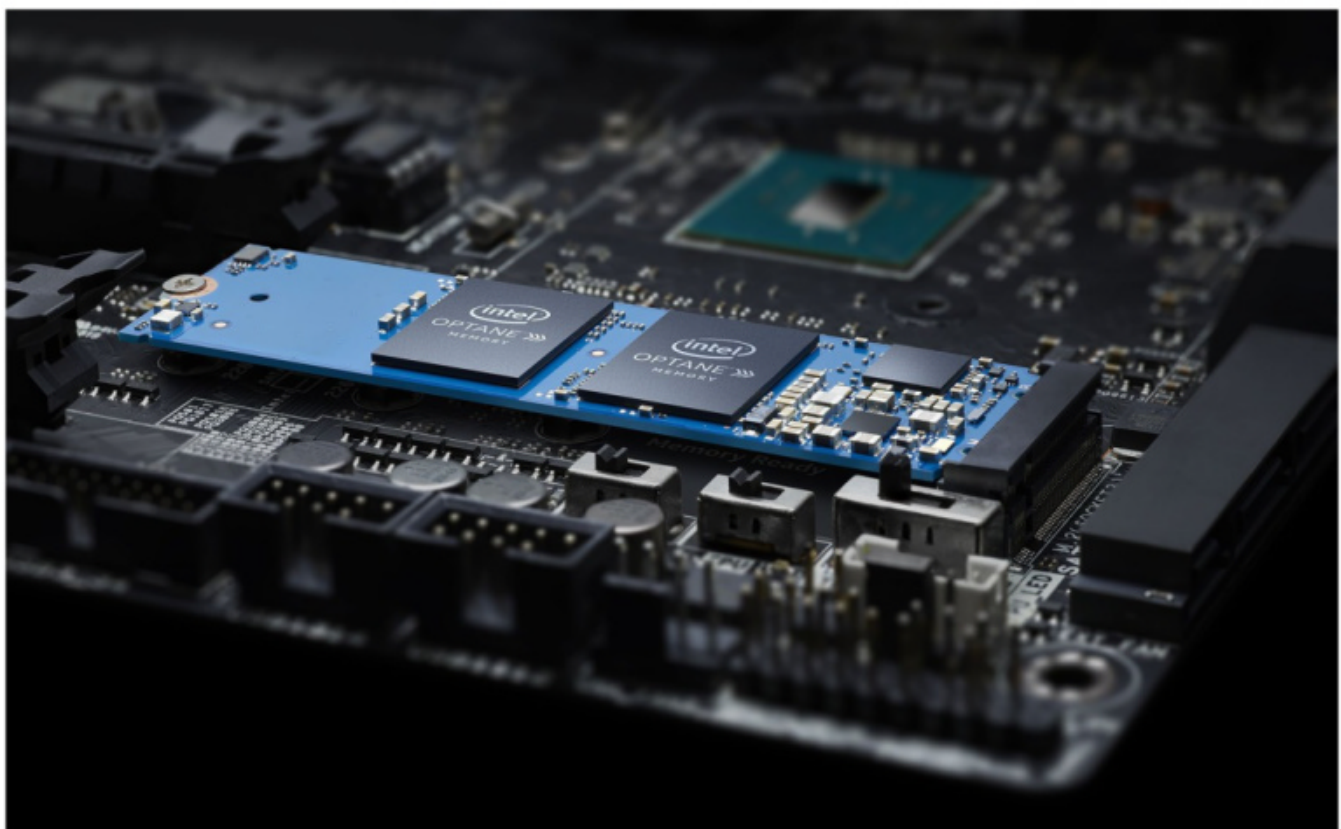
BOTTOM LINE

As I said, these features are available to Xbox Insiders to test starting today, and after seeing these screenshots I'm actually pretty excited to give it a try. Until now, Game Bar's just duplicated tools I already had available through other means. Better volume management tools, though? And a pinnable performance tracker? They're not flashy features, but they're exactly the kind of hooks Microsoft should be providing at the system level.

Add in Spotify integration and the rest, and it's at least a good reason for me to hit Win-G and give it a shot. 

Intel's Optane Memory finally supports Celeron and Pentium budget PCs that need a boost

A recent Optane Memory driver update does the trick. **BY BRAD CHACOS**



Two long years after Intel debuted its radical—and awesome—Optane Memory caching SSDs (go.pcworld.com/opmm), the company has finally decided to embrace the processors that could appreciate the technology's benefits the most. A recent Optane Memory driver update added support for Intel's budget-friendly 8th-gen

Celeron and Pentium CPUs, as Anandtech (go.pcworld.com/antk) noticed in early April.

Optane Memory gives pokey mechanical hard drives a shot of SSD-like speed by intelligently caching your most-used programs and files to speed up access. You install an Optane Memory drive in an M.2 slot on your motherboard, and Windows sees it and your hard drive as a single combined

storage pool. Intel's software delegates which data should go on which drive. When you open a commonly used program that's stored on the Optane Memory, speeds drastically increase. It makes a world of difference in terms of raw performance.


Better yet, Optane Memory modules fit into budget builds, costing just \$33 for a 16GB drive (go.pcworld.com/16gb) or \$60 for a 32GB cache (go.pcworld.com/32gb) on Amazon.

That should make Optane Memory a juicy upgrade for budget big-box desktop PCs filled with spacious hard drives, right? Wrong—at least until now. Intel made the baffling decision to limit Optane Memory compatibility to systems configured with pricier Core processors. Those machines tend to come loaded with native solid-state storage that don't need Optane Memory's

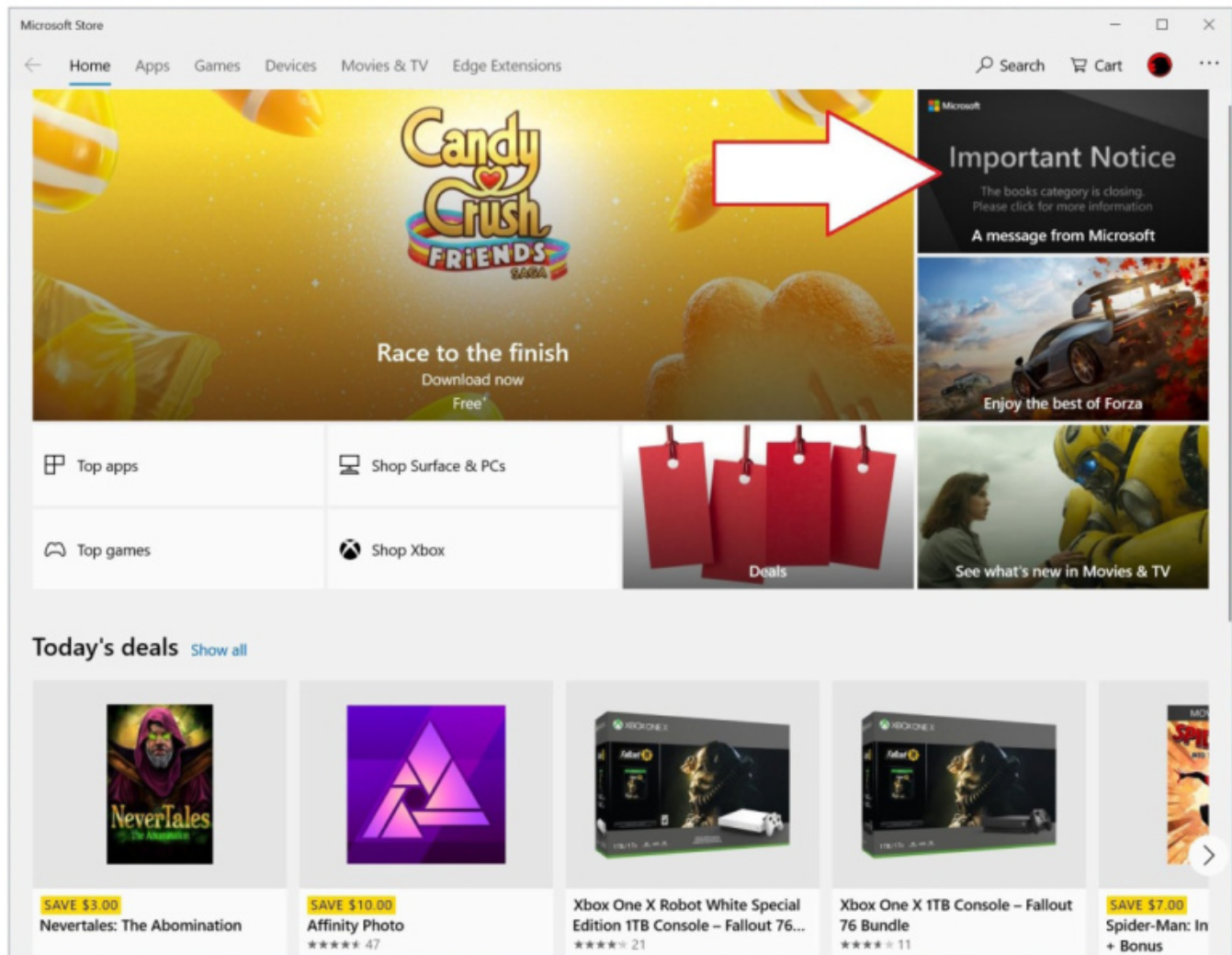


benefits. Now that the technology plays nicely with processors that actually come paired with mechanical hard drives on a regular basis, it makes a lot more sense to invest in an Optane Memory stick.

Hopefully the shift didn't come too late for the futuristic storage tech. In January, Intel killed "Core+"-branded computers (go.pcworld.com/crbp) that pair its processors with Optane Memory, claiming that desktop buyers choose to buy their processor and Optane Memory modules separately. The bundles persist for laptops.

Buyer beware: If you're interested in giving your hard drive more pep in its step, be careful about the Optane solution you're buying. The affordable Optane Memory modules discussed here act as a caching solution that augments spinning drives, while pricier products like the Intel Optane 905P—our pick for the fastest SSD available (go.pcworld.com/905p)—are a more cutting-edge take on standalone solid-state storage, instead. 





Microsoft has closed its ebookstore, and everything you purchased will vanish in July

Microsoft to offer refunds, plus a bonus if you've marked up an ebook. **BY MARK HACHMAN**

Microsoft has shuttered its ebook bookstore, yet another move by the company away from selling traditional consumer goods and services, with

the exception of its Xbox console.

Microsoft made its decision without fanfare, simply posting a notice in the corner of the Microsoft Store app and removing the "Books" tab. Microsoft's notice now leads to

a support page and FAQ (go.pcworld.com/bkfq) where Microsoft posted the answers to the questions consumers want to know: namely, what will happen to my books?

The answer, simply put, is that they'll disappear entirely sometime around July 2019, and you'll be given a full refund. If you ordered or rented an ebook before today, your order will be canceled and refunded. Free ebooks downloaded via the Microsoft Store app will also disappear, and they won't be available after July, either.

Microsoft didn't say why it was discontinuing its ebookstore, though lack of demand was probably a factor. Microsoft promoted its Books tab simply through the Store app, without any overt marketing of its contents or any deals within—unfortunately, a somewhat typical Microsoft failing. The ebookstore also had two likely-fatal flaws: ebooks purchased within the Books tab weren't downloadable, and they were readable only within the Microsoft Edge browser, which has a meager 4.4-percent share of the browser market.


Microsoft's ebooks experience began bumpily (go.pcworld.com/h2rd), without the bookmarks and annotations you'd expect. Unfortunately, even though those capabilities arrived later—along with some nifty PDF capabilities (go.pcworld.com/msed)—it's possible that customers had moved on. After all, Microsoft's ebook competitor was Amazon, whose mammoth online bookstore

If you did buy into Microsoft's Edge ebook experience, complete with annotations, there is a small bonus: Microsoft will pay you an additional \$25, credited to your Microsoft account.

already boasted tons of titles that could be downloaded and read within Amazon's full-featured Kindle app.

If you did buy into Microsoft's Edge ebook experience, complete with annotations, there is a small bonus: Microsoft will pay you an additional \$25, credited to your Microsoft account. (That won't save your annotations, though, as they'll disappear with the rest of your files.)

Microsoft didn't say exactly when in July the ebooks would disappear, implying that it will occur on an individual basis. "Your books will be removed from Microsoft Edge when Microsoft processes the refunds," Microsoft said.

What this means for you: For anyone who's watched Microsoft continue to turn away from the consumer market, most recently killing its Groove music service in 2017 (go.pcworld.com/klgr), the shuttering of its meager ebook service isn't surprising—but it is disappointing. At least Microsoft's Movies & TV tab within the Microsoft Store app appears to be alive and well, with lists of frequently rented movies and TV shows, and, more importantly, sales and discounts. 



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Amazon All-New Kindle: Front lighting and a better screen elevate this entry level e-reader

Budget-minded book lovers no longer have to sacrifice key features to save money.

BY MICHAEL ANSALDO

Amazon's All-new Kindle brings its entry-level e-reader out of the dark ages. With the addition of glare-free, adjustable front lighting, it allows users a more comfortable reading experience day or night without having to spring for the higher-priced Kindle Paperwhite or the luxe

Kindle Oasis.

The All-new Kindle replaces the 8th-generation Kindle e-reader and retains many of its slimmed-down specs. It does, however, introduce a few upgrades including improved E Ink technology and a capacitive touchscreen. With special offers—i.e., ads—enabled, it costs \$89.99, a \$10 increase over

the prior generation. Without special offers it's priced at \$109.99.

SPECS, FEATURES, PRICE

Storage: 4GB

Display: 6-inch (diagonal width) with E Ink Carta and four white LEDs, 167 ppi, 16-level grayscale

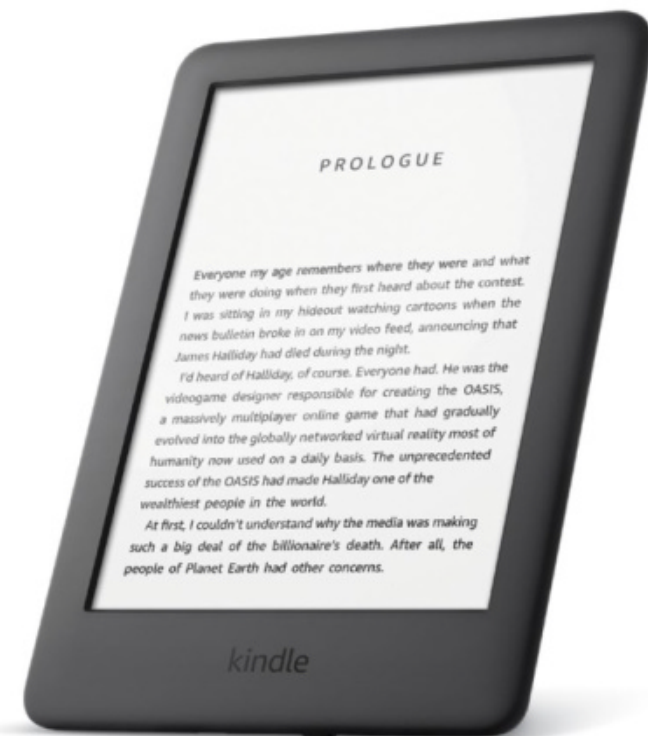
Dimensions: 6.3 x 4.5 x 0.34 inches

Weight: 6.1 ounces

Connectivity: Bluetooth and Wi-Fi

Battery life: Up to four weeks on a single charge

Special Offers: Save \$20 if you allow ads to be displayed on your lock screen, or pay \$20 if you don't. A three-month trial of the Kindle Unlimited service (access to a large



The All-new Kindle (10th generation, 2019) will come in black and white case colors.

library of content without per-product fees) is included, and is normally \$9.99 monthly.

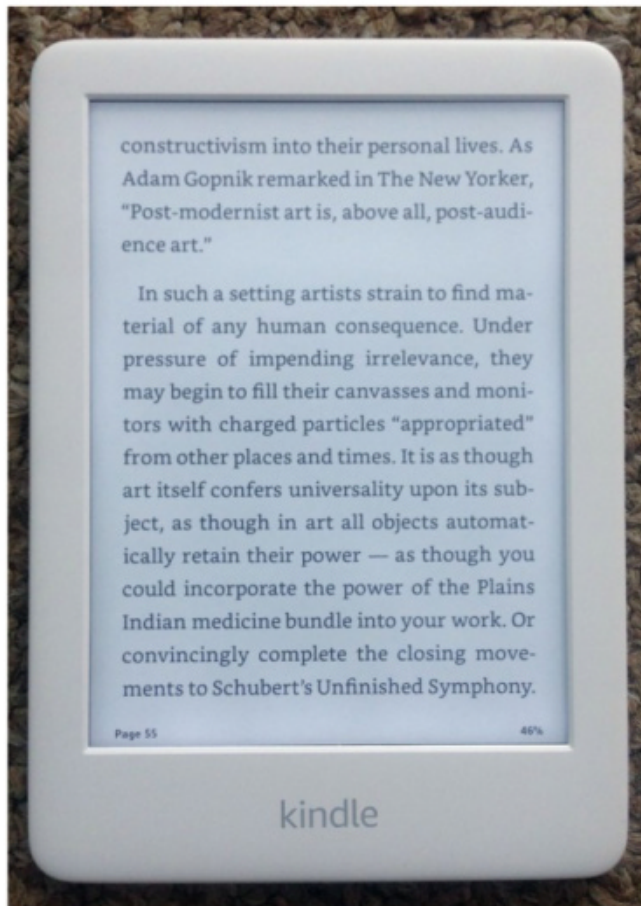
DESIGN

When I first unpacked the All-new Kindle, I couldn't discern much difference between its design and my 8th-gen Kindle's. Side-by-side comparison revealed some slight but obvious differences, though. Although they have roughly the same dimensions—about 6 by 4.5 by 0.34 inches—the older model had a fairly flat profile, while the All-new Kindle's is more contoured. The newer Kindle is also a hair heavier than its predecessor: 6 ounces, compared to 5.7 ounces before. It's perceptible when you hold one in each hand and gives the All-new Kindle a sturdier feel, but doesn't negatively impact long reading sessions.

Marginal though they may be, these differences mean you won't be able to fit the All-new Kindle into 8th-generation cases (I tried). Amazon is selling cloth case covers for the new models, available for \$29.99 in four colors: Sandstone White, Charcoal, Cobalt Blue, and Punch Red.

The all-new Kindle retains the 8th generation's 6-inch display with 167 ppi pixel density, but upgrades from E Ink Pearl to E Ink Carta for sharper text. It also adds a capacitive touchscreen to minimize errant swipes.

The big addition, of course, is front lighting, courtesy of four LEDs. If you're keeping track, that's one LED fewer than the



The All-new Kindle uses improved E Ink technology for crisper text.

Kindle Paperwhite has, and only a third of the total offered on the Kindle Oasis. They provide even illumination edge to edge on the display, though without an ambient sensor, so you have to manually adjust their brightness to complement room lighting.

As the All-new Kindle still qualifies as the line's budget model, you still get only 4GB of storage (as compared to 8GB or 32GB on the next model up, the Kindle Paperwhite). That's plenty for a substantial eBook library, but if you also want to include audiobooks—which you can play on an external speaker using the

device's Bluetooth connectivity—you'll find that storage disappearing much quicker.

Whichever format you prefer, Kindle Store or Audible purchases are sent to the device via Amazon's Whispersync service.

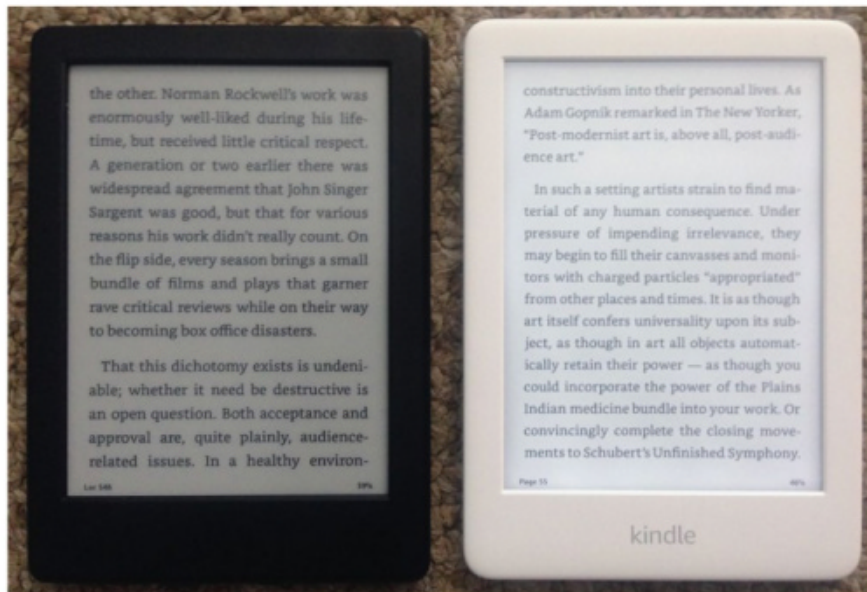
Alternately, you can side-load your reading material via USB, or email it to the device using its Send-to-Kindle address.

Amazon promises four weeks of battery life with a full charge, the same as the 8th-generation Kindle. Mind you, that's based on a half-hour of reading per day, with wireless and Bluetooth off and the light setting at 13, which is less than half the full brightness. Outside those strict parameters, battery life will vary considerably. Audiobook streaming over Bluetooth will always drain the battery faster.

USAGE

The All-new Kindle presents no particular learning curve if you've used the interface over the last few years. You can access the Kindle Store, Goodreads, and features like X-ray and Smart Lookup as you've done before. If you're not already a seasoned Kindle user, the device surfaces tips and tutorials the first time it's powered on, so you can quickly get your bearings.

If you've only ever used entry-level Kindles, the most dramatic change to the user experience is the front lighting. Without it, the 8th generation and its budget-priced predecessors required you to either limit your



The All-new Kindle (right) retains much of the previous generation's specs but adds front lighting and improved screen technology.

reading to daylight hours in well-lit environments or get yourself a book light (which kind of undermines the high-tech experience). The All-new Kindle allowed me to read comfortably in bed without disturbing my spouse with bright exterior lights, and had none of the eye-fatiguing effects of reading on an iPad or other backlit screen. You can easily optimize the brightness for your environment using a slider in the settings menu, which is accessible from any page of text.

Comparing the screens of the All-new Kindle and the 8th generation, I didn't see much of significance. The new device's E Ink Carta screen displays text against a whiter background, whereas the older model's background is slate-gray, and that may translate to being easier on the eyes. If the text itself is crisper, it's too negligible to

notice. The only real difference I encountered is that the All-new Kindle's capacitive touchscreen required that I use more pressure when turning pages, and they turned ever-so-slightly slower. None of this detracted from the joys of being immersed in a good book.

BOTTOM LINE

Saving money on a Kindle typically has meant sacrificing

features that would provide the most enjoyable reading experience. That sacrifice is no longer necessary. With its adjustable front lighting, upgraded screen, and improved E Ink technology, the All-new Kindle finally opens the full Kindle experience to budget-minded book lovers. 🔌

Amazon All-new Kindle



PROS

- Frontlighting for comfortable reading in all environments.
- Can play audiobooks over Bluetooth speaker.
- Improved E-Ink and touchscreen technology.

CONS

- Audiobooks will deplete 4GB of storage quickly.

BOTTOM LINE

The All-new Kindle is an affordable way to experience the best e-reader available.

\$109



Alienware Area-51m R1: Fast, big and upgradable

Alienware's redesigned powerhouse laptop promises the Holy Grail of gaming laptop features. **BY GORDON MAH UNG**



Alienware's Area-51m flagship gaming laptop is big, thick, and fast, a return to form that should reassure people who got worried when the company unveiled the thin-and-light m15 (go.pcworld.com/al15) last year. The new Area-51m very well might be the first gaming laptop to bring the Holy Grail of features to consumers: Upgradable graphics and an upgradable CPU.

SPECS AND FEATURES

The Area-51m's spec list is all good stuff, and it'll cost you. Our review unit is the highest-end SKU, which starts at \$4,050 (available at Dell.com [go.pcworld.com/ar51]) but is



**VIDEO: ALIENWARE
AREA-51M R1: FAST,
BIG AND UPGRADABLE**

Watch now at go.pcworld.com/51m

\$4,500 as configured below. For slightly more modest budgets, the lowest-end model starts at \$1,950 and is nothing to sneeze at. Also note, the white “Lunar Light” color is a \$50 upgrade over the dark-gray “Dark Side of the Moon” color.

CPU: Intel 8-core Core i9-9900K with Hyper-Threading. Alienware also offers an 8-core Core i7-9700K without Hyper-Threading and a 6-core Core i7-8700K with Hyper-Threading

GPU: Nvidia GeForce RTX 2080, in a custom-upgradable version we’ll describe further below. RTX 2060 and RTX 2070 are also available.

RAM: 32GB DDR4/2400. Other RAM options include 8GB, 32GB, and 64GB.

Screen: 17.3-inch FHD (1920x1080) 144Hz Anti-Glare IPS Display with G-Sync and Tobii eyetracking. Other screen options mix-and-match G-Sync or Tobii eyetracking, or drop to a 60Hz refresh rate.

Storage: Our review unit carried 512GB of SSD storage using two M.2 NVMe drives, plus a 1TB hard drive. Many other storage options are available.

Ports: Two 10Gbps USB-A, one Thunderbolt 3, headset jack, mic jack, full-size HDMI 2.0, miniDisplayPort 1.4, Alienware Amplifier port, 2.5Gb Ethernet, lock port.

Power: The Area-51m we reviewed included a 330-watt brick for home use, and a 180-watt brick that’s theoretically mobile—lighter than the 330-watt brick, anyway. You can use both power bricks together, or separately, but performance will be affected in the latter case.

Dimensions: 15.9 x 16 x 1.6 inches.

SURPRISINGLY ‘LIGHT’ AND ‘SMALL’

If we told you the Area-51m was surprisingly light and small, you’d probably think we’d lost our minds. Naked, the Area-51m tipped our scale at 8 pounds, 15 ounces. With its two power bricks, it’ll take you to 13 pounds, 11 ounces.

Considering what’s inside of it, it’s almost light. We looked around at a few competing 17.3-inch designs: Some of them start at 12 pounds, and with power bricks will top 17 pounds. The Area-51m is, in fact, lighter than its predecessor, the Alienware 17 R5. which



The Area-51m features Thunderbolt 3 along with an Alienware Amplifier port on the rear.

weighs 9 pounds, 12 ounces. The company said it achieved this by using a mostly magnesium body that allowed it to shift weight from the body to the cooling components. The plastic bottom lid helps, too.

You may also be shocked to find that the Area-51m is relatively small, at least in width and height. However, it's almost a half-inch deeper than comparable laptops thanks to its signature-Alienware big tuckus.

WHAT THE AREA-51M'S DESKTOP CPU BRINGS

There are two standout features on the Alienware Area-51m: the replaceable desktop CPU, and the replaceable GPU. First, let's get into the socketed CPU and why it matters.

Once upon a time, most large gaming laptops used mobile socketed CPUs. Beginning with the 5th-generation Broadwell chips, Intel dumped socketed CPUs for all-mobile CPUs. That meant the ability to swap out the CPU down the road was impossible without also switching the motherboard—which, while technically possible, financially made no sense.

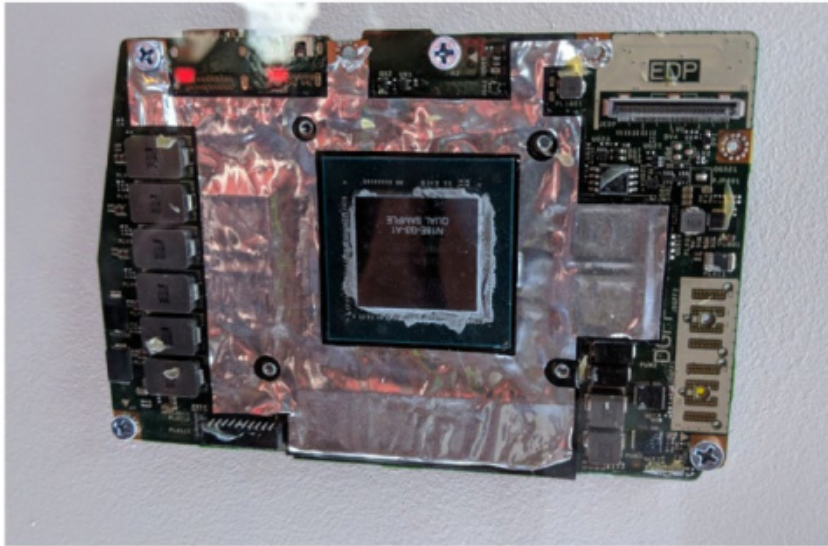


The motherboard of the Alienware Area-51m R1 features four SO-DIMM slots, two M.2 slots, and a standard LGA-1151 socket for the desktop CPU.

With the Area-51m, Alienware taps a standard desktop Core i9-9900K desktop CPU in an LGA1151 socket. What that gets you is 8 cores instead of 6, and a little more clock speed (5GHz, rather than 4.8GHz) compared to the fastest laptop CPU, the Core i9-8950HK. You can see both CPUs compared here (go.pcworld.com/i9hk) on Intel's ARK.

Because this is a transplant of a desktop CPU, Alienware also pairs it with a desktop Z390 chipset instead of the more common HM370 used in most gaming laptops. Z390 consumes more power than its mobile counterpart but offers far more expansion options, such as additional PCIe lanes and native 10Gbps USB 3.1 Gen 2.

A socketed processor typically means user upgrades, and two scenarios make sense. The first is you buy the cheaper Core i7-8700



The Holy Grail: Alienware said it designed a custom GPU module that can be replaced down the road with a faster model.

and upgrade to a Core i9-9900K down the road when they're on fire sale.

The other scenario is upgrading to a "10th gen" Core i7 or Core i9. Given Intel's history of dumping sockets or chipsets overboard, however, there's no guarantee you'll be able to do it.

That said, the chances that Alienware would do all of this work without offering at least one useful CPU upgrade is very unlikely, because it has deeper insight than we do into what's coming.

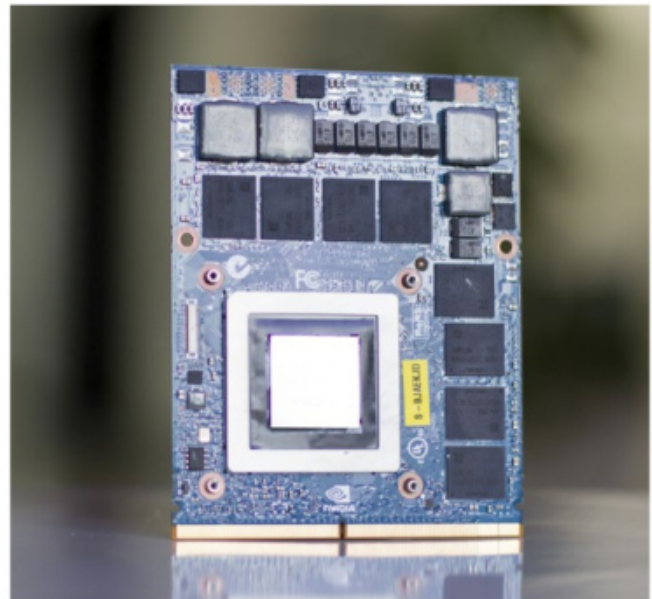
THE HOLY GRAIL OF GAMING LAPTOPS!

The most important component of any gaming PC is the GPU. In a desktop, the easy answer to better graphics is to upgrade to a newer or faster card. With a laptop, you're usually stuck with turning down visual quality settings or

resolution until you can no longer stomach it, at which point you buy a new laptop.

With the Area-51m, Alienware designed a custom graphics module that—in theory—can be upgraded down the road by the owner. While there have been smaller companies that actively market upgrade paths (Eurocom deserves a shout out here [go.pcworld.com/euro]), no major companies have taken this path and succeeded.

(External graphics cabinets are another answer, but they don't work for everyone. Some gamers need a truly portable setup, whether it's because they live in a foot locker, or they actually travel a lot.)



This Eurocom GeForce GTX 980m uses an MXM form factor and is a pseudo-standard that offers some laptops an upgrade path, sometimes.

WHY U NO MXM ALIENWARE!?

Alienware has taken some flack for the custom design rather than an “off-the-shelf” MXM card but company officials said there’s some misunderstanding about MXM—which the company has used before in its laptops. For one thing, Alienware said, Nvidia and AMD no longer support it with reference boards.

While the spec still exists, each card maker must design, validate and build their own for the latest GPUs. And although people believe all MXM cards to be “the same,” they’re not, and often are not easily interchangeable either.

Faced with basically building custom boards to fit the MXM spec, Alienware reached into the Dell IP parts bin and borrowed the Dell Graphics Form Factor that Dell’s workstation group was developing for laptops.

Unlike MXM, which specifies shape and placement of components, the DGFF is looser and allowed Alienware to design a custom card specifically for the Area-51m. The custom DGFF also allowed Alienware to build a much slimmer design. The company said if it had used MXM, the Area 51m would have been another 4mm or 5mm thicker just based on the connector MXM uses.

If you’re seeing the words “proprietary” and “custom” and think it’s a play to soak you



We have no objections and no issues with the Area-51m’s keyboard and trackpad, which are RGB, naturally.

on any upgrade costs, Dell insists that’s not the case. Dell’s vision is to drive end-user upgrades as a feature to make people buy its laptops in the first place. If it charged more than competing MXM-based designs, that would drive people away from the laptop, not toward it.

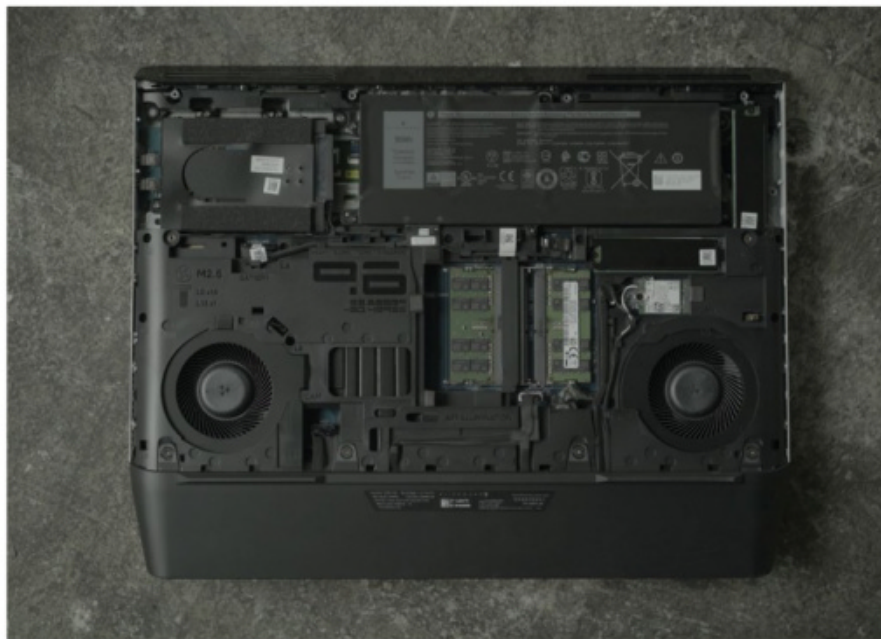
It’s not like MXM-based designs are exactly cheap. Canadian laptop company Eurocom is one of the few that actually sells upgrades for its own laptops, along with Clevo, older Alienwares, and MSI laptops. The cost of a GeForce GTX 1080 MXM card? \$1,249. The situation isn’t any better on eBay: We routinely found GTX 1080 MXM cards for \$1,100 new and \$700 used.

There’s a real chance future GPUs for the Area 51m will be cheaper than their MXM equivalents. Of course, without any actual upgrade GPU kits to compare, we’ll reserve

judgment. Dell did say its plan for upgrades are still in the works. And yes, if you buy a laptop with a GeForce RTX 2060—the company has plans to offer a GeForce RTX 2070 and GeForce RTX 2080 upgrade for it. Right now though, Alienware hasn't rushed them out because it doesn't think there's much demand for upgrades for a brand-new laptop.

HOW THE UPGRADE WILL WORK, MAYBE

With current (and future GPUs) it probably won't be just the GPU that'll need an upgrade. For example, if you buy the GeForce RTX 2060 version, you'll get dual 180-watt power bricks, rather 180- and 330-watt bricks that come with our review unit's RTX 2080. For those buyers, Dell said it plans to bundle the more powerful cooling system (as the existing cooling system has to be removed during the upgrade process anyway) and the required power brick to run the laptop. The company said it expects to have these kits for current GPUs available in two months. TL;DR: Dell will basically include what you need for the upgrade with the kit.



Getting to the inside of the Area-51m is fairly easy. You can access the RAM, two M.2 drives and 2.5-inch drive bay once the bottom is off.

AND YES, YOU'LL BE ABLE TO DO IT YOURSELF (HOPEFULLY)

Alienware officials said unlike some laptop maker's upgrade programs, which require you to send back a laptop to have it upgraded, Alienware's goal is to make it a true customer-based upgrading experience. One day, if the GPU gods are kind, you'll buy a next-generation card from Dell and crack the shell open yourself.

The company said upgrading the graphics, GPU, RAM or storage won't void the warranty. Well, at least early on. Alienware said the design of the Area-51m is intended to allow for GPU upgrades. If enough customers brick their laptops doing the upgrade, Dell may have to go to option two: an at-home



You get a 180 watt and 330 watt power bricks with the Area 51m.

upgrade service—which will also be offered as an option for those too busy or too cautious to do the upgrade themselves. The company won't know, of course, until enough upgrades are done.

Alienware said it planned for a thermal budget of 200 watts for the GPU cooling system. That means any future upgrade, say a GeForce RTX 3080, would have to be within that envelope even to be offered.

WHY THIS MIGHT ACTUALLY WORK

Because no one knows what any next-generation GPU will output in heat, let alone when or what the next-gen GPUs from AMD or nVidia will be, it's a leap of

faith of that Alienware's upgrade will even work. That's the main reason previous attempts have failed as well. Asus tried it in 2007 with its C90s, using an MXM module with "at least one" promised upgrade. That upgrade, however, never came, because the next generation of Nvidia laptop graphics only got hotter and more power-hungry.

The reason Alienware's Area-51m has a better

chance is because laptop GPUs have mostly plateaued in thermals. With the move to a 7nm process from the RTX 2080's 12nm, the smart money is power and thermals should be the same or even better.



The 2.5Gb Ethernet, Alienware Amplifier, HDMI and miniDisplayPort are routed out the rear of the Area-51m.

The desktop Core i9-9900K easily outpaces other desktop CPUs, including a Ryzen 7.

PERFORMANCE

The proving ground of any gaming laptop is always in performance. Our Area-51m's Intel Core i9-9900K CPU packs 8 cores plus Hyper-Threading.

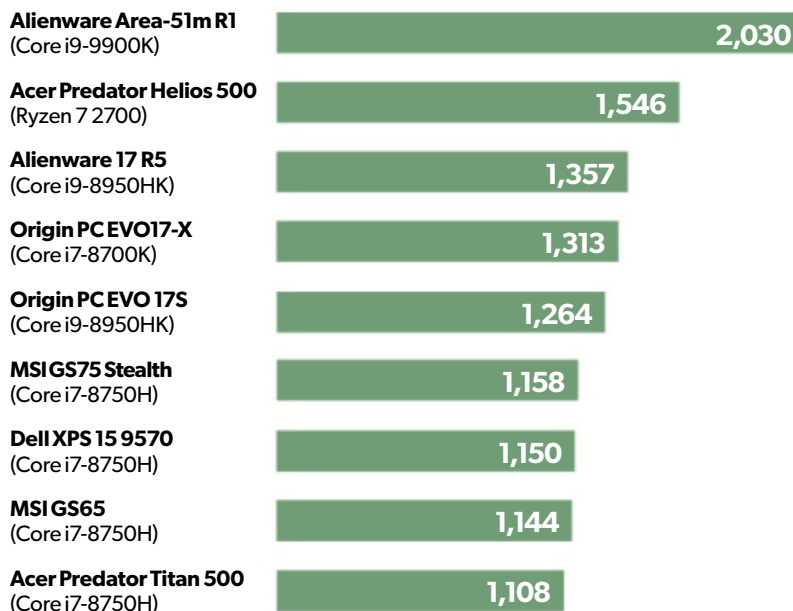
The main difference between a mobile CPU and a desktop CPU (besides the ability to change it) is the number of cores. The top-of-the-line laptop Core i9-8950HK offers 6 cores with Hyper-Threading. While the mobile CPU has decently high clocks, it can't keep up when you need more CPU threads. You can see that in our Cinebench R15 test run, where the desktop Core i9 simply pounds all others.

While you should

Single-threaded performance sees a three way split between the top-end Intel chips.

Cinebench RT15 nT

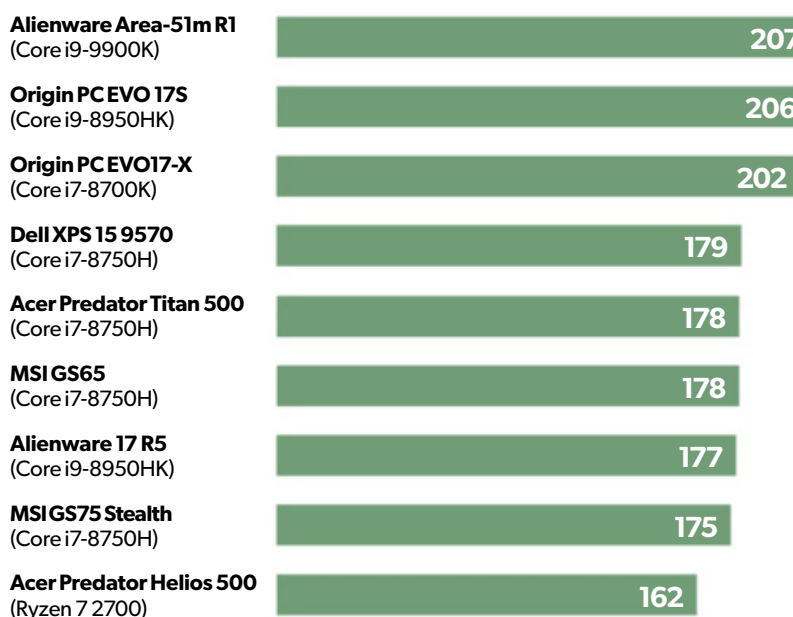
(Threads)



LONGER BARS INDICATE BETTER PERFORMANCE

Cinebench RT15 1T

(Threads)



LONGER BARS INDICATE BETTER PERFORMANCE

expect a Core i9-9900K to dust off a 6-core Core i7-8750H, the real eyebrow-raiser is how well it dispatches that Core i7-8700K in the Origin EVO-17X, the Core i9-8950HK in the Alienware 17 R5, and the Ryzen 7 2700 in the Acer Predator Helios 500. That last CPU, mind you, is an 8-core desktop chip as well.

Performance of the Core i9-9900K in Cinebench is basically a half-step back from what we've seen from a bone "stock" Core i9-9900K in a desktop (go.pcworld.com/i90k).

Because most apps rarely use all cores, we also look at single-core Cinebench performance. Although the test is a 3D modelling benchmark and doesn't necessarily represent performance in all apps, it's still a

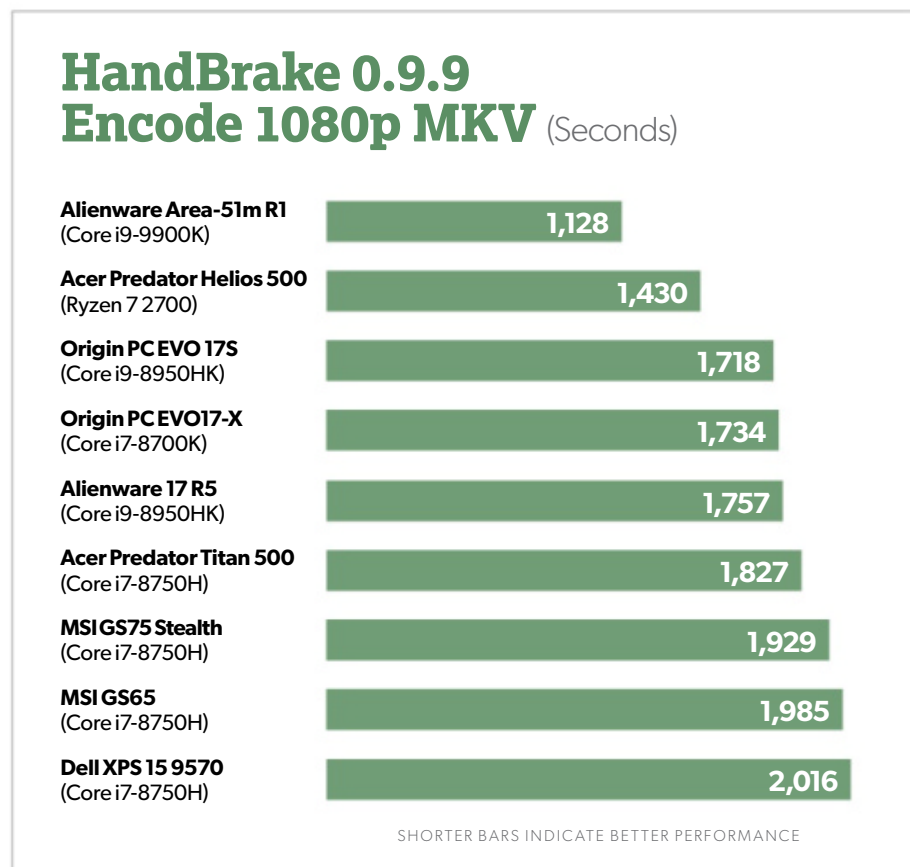
good way to judge what you might see in Photoshop or, say, Chrome. You see all of the CPUs push their top clock speeds, and we essentially see a three-way tie between the Core i9-9900K, the Core i9-8950HK, and the Core i7-8700K, each of them at or near their max.

If Ryzen 7 in a laptop is expecting to compete, it'll have to run at higher clocks than what we see here.

Our last CPU test uses HandBrake to convert a 30GB 1080p video using the Android Tablet preset. This test can take 30 minutes to run, heating up the CPU for a longer period than Cinebench R15 does in its one-minute run. Because HandBrake favors more cores, it's no surprise that the Core

i9-9900K again drop-kicks the 6-core CPUs. It also has a hefty lead over the 7-core Ryzen 7 2700 in the Acer Predator Helios 500. We'd credit this to two things: the higher clock speeds, and the cooling system in the Area-51m, which can take HandBrake's longer load in stride.

Longer-running loads such as our HandBrake encode can show compromises in performance in a laptop.



GAMING PERFORMANCE

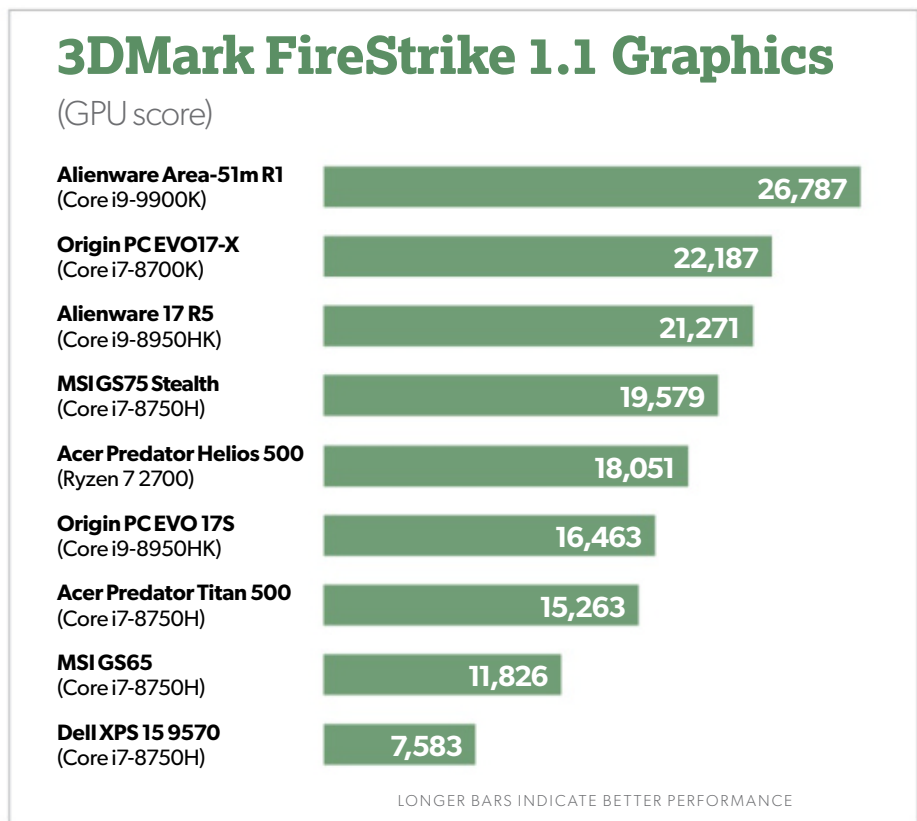
Now on to the main attraction: gaming performance.

First up, we take a look at UL's 3DMark FireStrike. For this DX11 test, we'll look solely at the graphics score, which cuts the CPU out as a factor. Yet again (as it should be) the Area-51m's RTX 2080 is the top dog, with a healthy uptick even compared to overclocked GeForce GTX 1080 laptops.

3DMark FireStrike dates back to 2013 and was intended as a strenuous synthetic test of that era's hardware. Much has changed since then, so we also wanted to see how the Area-51m's RTX 2080 did in the 2016-era 3DMark Time

Spy test. This test is DX12, and as you can see from FutureMark's own documentation below, it uses a ton more shaders, tessellation, vertices, and triangles than FireStrike.

With the heavier workload we see the

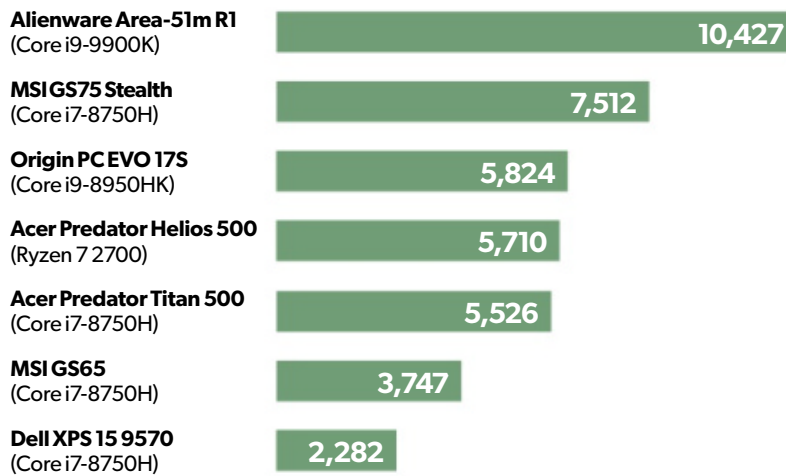


	3DMARK FIRE STRIKE GRAPHICS TEST 1	3DMARK FIRE STRIKE GRAPHICS TEST 2	3DMARK TIME SPY GRAPHICS TEST 1	3DMARK TIME SPY GRAPHICS TEST 2
Vertices	3,900,000	2,600,000	30,000,000	40,000,000
Triangles	5,100,000	5,800,000	13,500,000	14,000,000
Tessellation patches	500,000	240,000	800,000	2,400,000
Compute shader invocations	1,500,000	8,100,000	29,000,000	31,000,000

3DMark Time Spy uses far more modern graphics features than the 2013-era 3DMark FireStrike.

3DMark Time Spy 1.1 Graphics

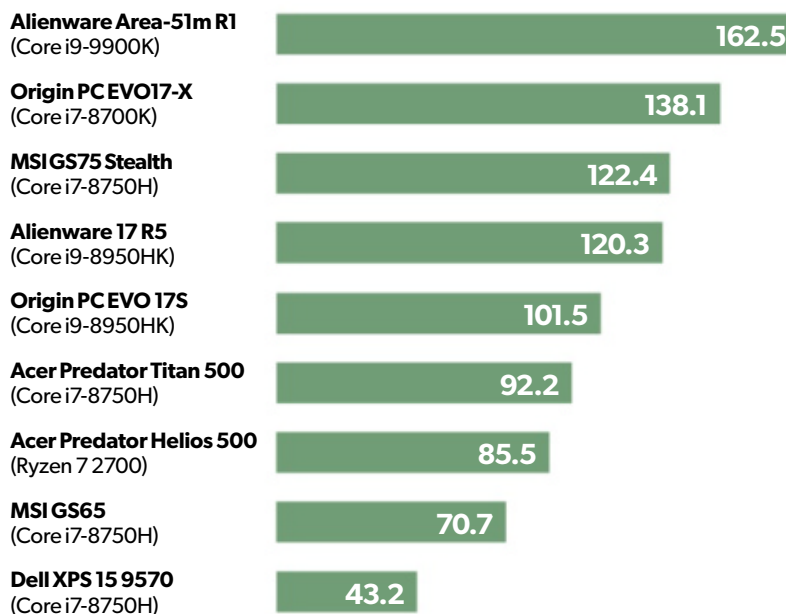
(GPU score)



LONGER BARS INDICATE BETTER PERFORMANCE

The DirectX 12-based 3DMark Time Spy uses a ton more shaders, tessellation, and vertices than the DX11-based 3DMark Fire Strike.

Rise of the Tomb Raider Very High DX11 19x10 (Fps)



LONGER BARS INDICATE BETTER PERFORMANCE

Area-51m open up an even larger gap over all other laptops we've tested. For comparison, the Area-51m with its RTX 2080 is about 25 percent faster than the Alienware 17 R4 with GTX 1080. In Time Spy, the Area-51m is about 38 percent faster than the Alienware 17 R4.

Unfortunately, we live in a world where benchmark graphics workloads may not match what developers are actually doing. They do, after all, have to make a living off selling a game, not a benchmark. Even though the Area-51m's RTX 2080 is demonstrably faster in a perfect world, in the real world it's closer than you'd hope for.

In *Rise of the Tomb Raider* set to Very High in DX11 mode at 1920x1080 resolution, you're looking

The RTX 2080 in the Area 51m easily outpaces even overclocked GTX 1080 GPUs, even at a relatively "low" resolution of 1920x1080.

Running Middle-earth: Shadows of Mordor at 1920x1080 and Ultra quality, nothing can touch the Area-51m's RTX 2080.

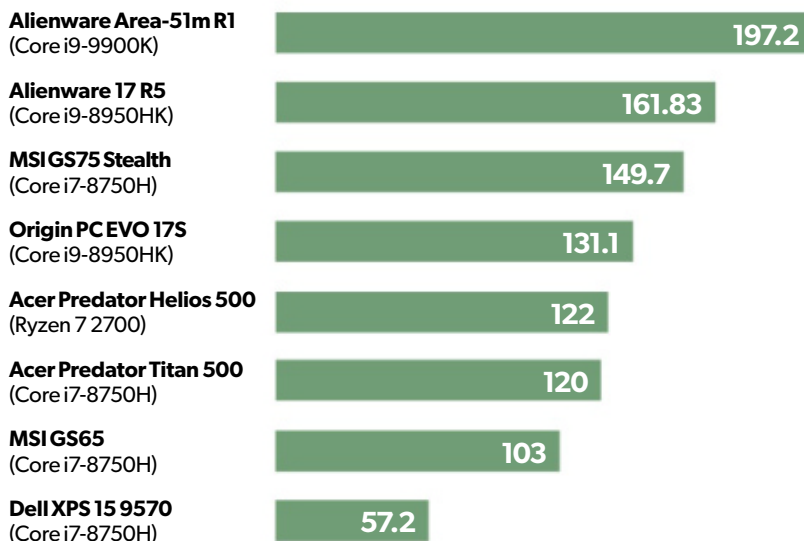
at about a 30-percent difference between the Area-51m and the Alienware 17 R4. The full-tilt RTX 2080 easily outguns even overclocked GTX 1080 laptops.

Our last test is *Middle-earth: Shadows of Mordor*, also run at 1920x1080, set to Ultra quality, and using the 4K texture pack. Again, the RTX 2080 smokes all that came before it. We'll be interested to see how the Area-51m's lead holds up as other full-tilt RTX 2080 come in for review, but it's likely going to be a tough one to beat.

BATTERY LIFE

We take a view that laptop battery life is based on context. We know a heavy, thick gaming laptop will spend 95 percent of its life on AC. So, call us surprised

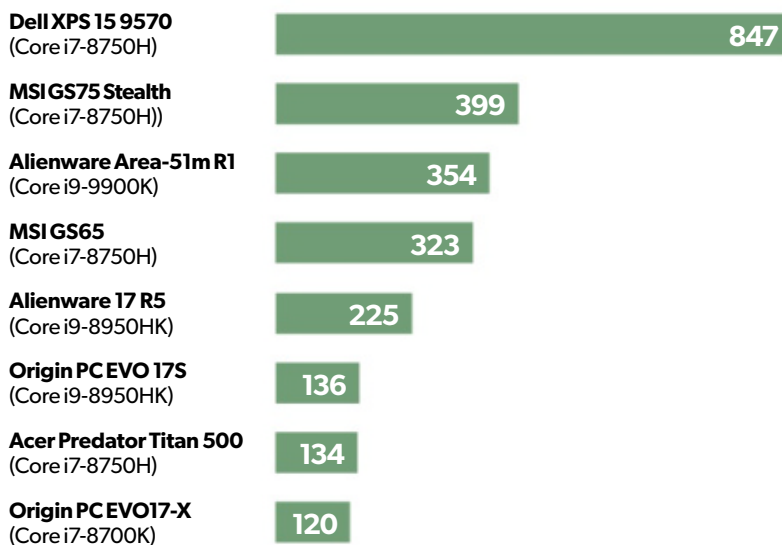
Middle-earth: Shadow of Mordor Ultra (Fps)



LONGER BARS INDICATE BETTER PERFORMANCE

4K battery life

(Minutes)



LONGER BARS INDICATE BETTER PERFORMANCE

Battery life is surprisingly good considering the Alienware Area 51m R1 uses a desktop CPU and features G-Sync.

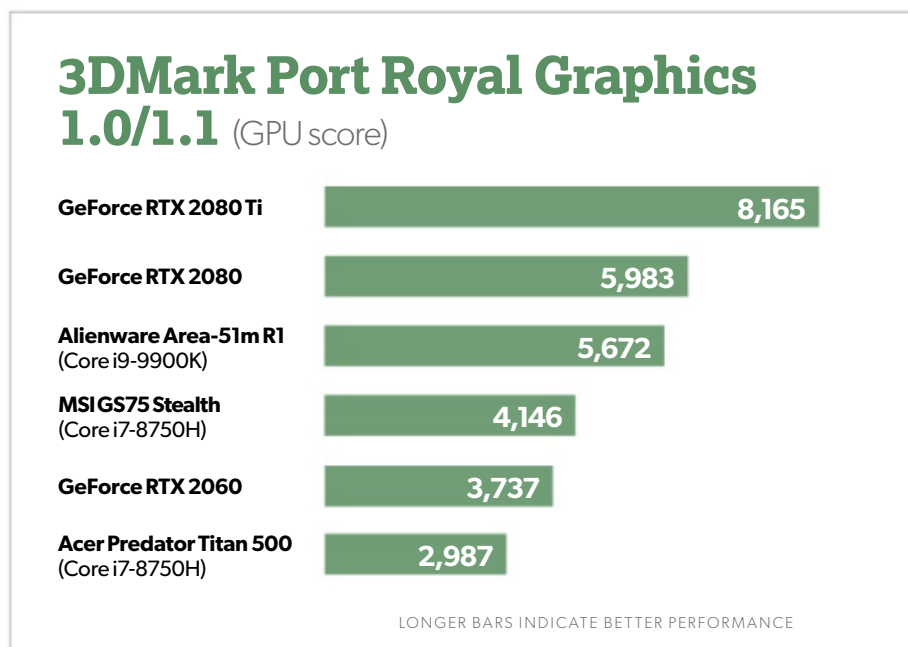
when the Area-51m and its 90-watt-hour battery clocked in just short of 6 hours of runtime while playing a video with the screen set to 250 to 260 nits and the wireless switched off. That's surprisingly respectable given that the laptop has a G-sync-enabled 144Hz panel, which means the mighty RTX 2080 is always switched on. That's typically a major battery-killer.

When you also factor in that the Area-51m has a desktop CPU and a desktop chipset, the Z390, we'd say this is amazing battery life—for video playback.

Just a reminder: If you fired up that RTX 2080 for a game, or pushed the Core i9-9900K in a CPU-heavy task, don't expect more than an hour of run time if you're lucky

RAY TRACING PERFORMANCE

With RTX-based gaming laptops so new, it's been hard to get a bead on how just how well they'll perform in the Promised Land of hybrid ray traced gaming. We were especially concerned after our review ([go.pcworld.com/ms75](https://www.pcworld.com/ms75)) of the MSI GS75 and its RTX 2080 Max-Q GPU, which sacrifices so much in clock speeds.



We've tested only three RTX-based laptops so far in hybrid ray tracing, with the Area-51m offering the best performance to date.

We run 3DMark's Port Royal graphics test, which measures hybrid ray tracing.

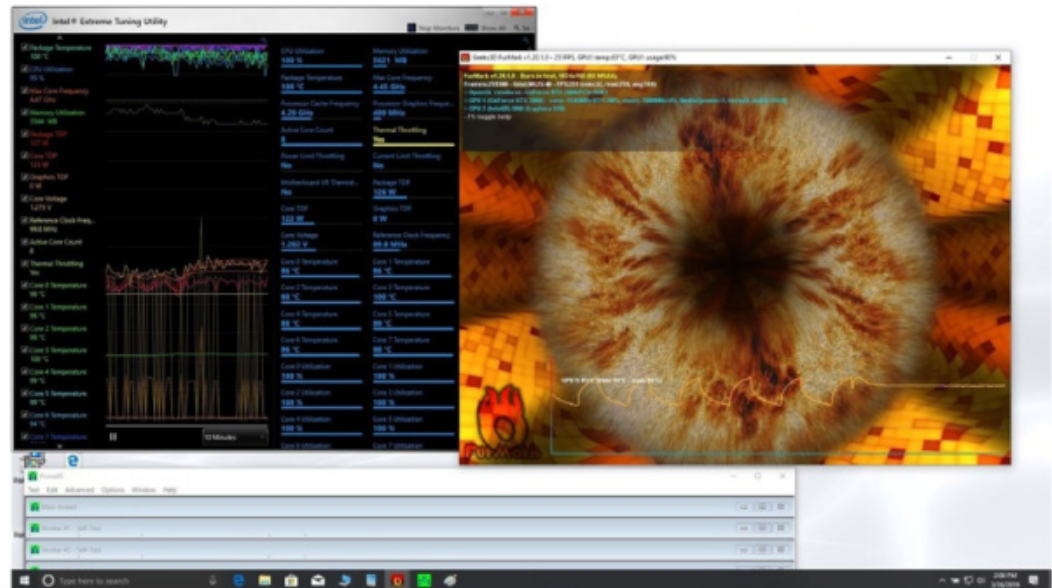
Comparing the results with some published desktop results, we can see the Area-51m's RTX 2080 is about five percent slower than a reference desktop RTX 2080 card. We'd say that's a pretty good win, especially compared to how the RTX 2080 Max-Q seems to fall.

THERMALS

The biggest enemy of performance in gaming laptops is heat. We ran the GPU stress test Furmark along with the CPU (the non-AVX version) stress test Prime 95 (using the in-place torture test.) We let it run with the fans set to Quiet, and then set to Full Speed.

On Quiet, the fans were far more restrained, and you can see the result on the

We ran the laptop with a GPU and CPU stress test in its quiet fan mode and then switched to full speed. As you can see, the GPU's performance isn't quite the 1710 base speed but considering we're pushing the CPU and GPU, that's not bad



GPU's performance below. The RTX 2080 would run up and down in clock frequency, while the CPU maxed out at about 4.3GHz to 4.4GHz. With the fans set to a roaring full speed, the CPU hovered in the 4.45GHz to 4.6GHz range, with the RTX 2080 settling down at about 1,500MHz.

The CPU on heavy loads will typically push 99 degrees Celsius. Some will see that as too hot, but it's not unheard of. Remember, this isn't a desktop with unlimited cooling capability and space. Laptops and space-constrained devices often push the envelope to chase performance. Some laptop makers will opt for lower temps—and lower performance—while others will opt for all-out performance.

The Area-51m sucks air in through vents on the bottom and

exhausts hot air out behind and from the sides. The system works quite well. Even after more than an hour of GPU and CPU torture tests, the keyboard was a comfortable 101 degrees. That may sound



After more than an hour of running both a CPU and GPU stress test, the Alienware Area-51m's keyboard topped out around 103 degrees Fahrenheit. That may sound like a lot, but if the cup of coffee or burrito you ordered was that temp—you'd send it back to the kitchen.

high to you, but it's basically lukewarm. You can see from our thermal image that most of the hot air is vented out the rear, rather than parboiling your mouse and mouse pad.

BOTTOM LINE

There are three main metrics for judging the Area 51m: performance, price, and upgrades.


On the performance front, it would be wrong to write anything other than flowery praise because, well, it's the fastest laptop we've ever seen. It truly crushes the more common Core i7-8750H-based laptops. It also has no problems stomping the Core i9-8950HK and Core i7-8700K. The surprise is how well it dispatches the Ryzen 7 2700, too. This thing is a beast.

The GPU is no less monstrous. The RTX 2080 easily outpaces GTX 1080s too and establishes itself as the new top dog. The caveat, of course, is that this is the first Core i9-9900K and RTX 2080 laptop we've seen, but given what we've seen, it'll be hard to beat.

The second criteria is price, and there it ranges from slightly expensive to unreasonable, depending on where you're coming from. We found mobile Core i9 and RTX 2080 laptops in the \$3,600 range, which makes the Area-51m we tested pretty pricey. But, if your goal is to step into a Core i9-9900K with an RTX 2080, expect to spend no less than \$4,000, with many charging

\$4,500 for comparable specs.

The last criterion is the one that we really have a hard time judging, and that's future upgrades. Alienware officials are very careful to avoid saying future upgrades are guaranteed. But they all but walk up to the line, cross themselves, and say by the grace of the GPU and CPU gods, you'll get an upgrade or more. Lacking actual upgrades yet, it's hard to render a verdict.

What we can say is that we applaud efforts to make laptops with upgradable components, or even the intention of upgradable components. While not everyone needs to pay the premium for the capability, the ability to extend the life of a laptop should be something all vendors strive for. 

Alienware Area-51m R1



PROS

- Desktop 8-core Core i9-9900K rules all.
- GeForce RTX 2080 offers far better performance than Max-Q version and leaves GTX 1080 cards in the dust.
- Potentially upgradable graphics.

CONS

- "Only" two M.2 slots and one 2.5-inch bay.
- Currently only 1080p options.
- Two different-sized power bricks feels funky.

BOTTOM LINE

Alienware's redesigned powerhouse laptop promises the Holy Grail of gaming laptop features: It's big, fast, beautiful, and even upgradable, with a desktop CPU and a custom upgradable GPU design.

\$4,499



Lenovo Legion Y7000: A smart, sophisticated gaming laptop you can actually afford

It's a cheap gaming laptop that also looks good. **BY HAYDEN DINGMAN**

First Lenovo learned to make cheap gaming laptops. Now it's learned to make cheap gaming laptops that also look good. I spent a few weeks with the Lenovo Legion Y7000, a stopgap release that sticks with Nvidia's GTX 10-series graphics cards as Lenovo's flagship Y500 and

Y700 models start to transition to higher-end (and higher-priced) RTX 20-series GPUs.

Is it a performance monster? The type of laptop you buy to impress your friends? Absolutely not. But it's a smart, sophisticated option that will perform admirably for at least a few years—and at a competitive price point.

VARIANTS

Lenovo's never one to shy away from options, and the Legion line seems to get more and more convoluted every generation. Case in point: The Y7000 and the Y530 are essentially the same laptop, but in a different skin. Last year we took a look at the cheapest Y530 model (go.pcworld.com/y530). This year, the opposite as we delve into the most expensive Legion Y7000—though “most expensive” sounds scarier than it should. Even fully tricked out, the Y7000 we reviewed retails for about \$1,100 (though the price varies from place to place, as it's not directly sold by Lenovo).

It's a decent price for what you get: An Intel Core i7-8750H processor, Nvidia's GeForce GTX 1060 graphics, 16GB of RAM, a 256GB SSD and a 1TB 7200 RPM HDD.

And the model we reviewed is the optimal setup, to my mind. There are a few other options, including a \$1,000 model with only 8GB of RAM and no secondary hard drive. There's also an ultra-budget option in the \$800 range, but that model's i5-8300H and GTX 1050 Ti are a poor investment for games today, let alone going forward.

Lastly, there's a second \$1,100 model that omits the 1TB hard drive in favor of upgrading from the 256GB to a 500GB SSD, but given the size of games these days I'd feel safer taking the larger overall space. That said, an SSD is both faster

and more reliable, so if you're diligent about finishing and then uninstalling games then that particular variant could be useful.

DESIGN

Last year we described the Lenovo Legion Y7000's counterpart, the Y530, as a “generic business machine.” The Y7000 is the opposite, unmistakably a gaming laptop—albeit one that's a hair classier than its peers.

The Legion Y7000 measures 14.2 by 10.5 by 1.0 inches and weighs a smidge over 5 pounds. That makes it smaller (and significantly lighter) than your average “desktop replacement” gaming machine, but still not nearly as portable as, say, the Razer Blade (go.pcworld.com/blde). The base is especially dense, a thick hunk of plastic that nevertheless hides some of its bulk with sharply tapered edges. It's nicely complemented by the lid, thin and aluminum-plated, with Lenovo's distinctive “Y” logo backlit in white. There's no other external branding, which is a classy (and confident) touch.



Pop the lid open and you'll find a 15.6-inch IPS display with a 1920x1080 resolution, a standard 60Hz refresh rate, and a slightly underwhelming 277 nits maximum brightness. It's not a great screen, and you won't want to do any color-intensive work on it, but there are no surprises here either. It's exactly the display you'd expect to see in a mid-tier gaming laptop. And the Legion Y7000's slim top and side bezels are a real coup at this price, helping reduce its overall footprint.

There's a compromise, though. Or rather, two compromises. First of all, the webcam is placed at the bottom of the screen, which is never a flattering angle. It's a shame Lenovo couldn't figure out a way to embed it at the top like Razer did with the similarly slim Blade.

The second issue: Lenovo's opted for a full keyboard complete with numpad and arrow keys, but because of the thin bezels there's less room to work with on the base as well. Thus the keyboard is slightly condensed, with

the Escape key pressed up against F1 and the right edge of the typing field brushing the numpad. Personally I think Lenovo would've been better off omitting the numpad entirely. You gain almost nothing from it, especially when it comes to gaming, and meanwhile it's comically hard to pinpoint the Backspace key. I was constantly misfiring the "4" on the



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numpad, my finger expecting a gap and then not finding one.

On the other hand, it's nice to have full-size arrow keys. Pointless, maybe—you rarely use them for games nowadays so again, they could have been omitted or shrunk to make more room for the main keyboard. But I often take advantage of the arrow keys when

writing, or while browsing the internet, and the Legion Y7000's setup is a lot more practical for those purposes than the half-sized arrow keys you usually find on laptops. It's a fairly pleasant machine to write on as well, with a stiff but snappy response to the keys, and white backlighting.

The trackpad is offset to the left, centered

on the space bar instead of the laptop itself. That's fairly standard on gaming laptops, but it can take some time to adjust. More annoying is that there are no discrete mouse buttons, though if you're gaming on a laptop you'll probably want to plug a mouse in ([go.pcworld.com/gams](https://www.pcworld.com/gams)). Be warned that both trackpad and the surrounding soft-touch plastic pick up more than their fair share of fingerprints and grease smudges. The "Fresh New Laptop" look doesn't stick around for long.

The speakers are unremarkable, but loud—which is good, because so are the fans. The Lenovo Legion Y7000 runs fairly cool for day-to-day use,



enough so the fans didn't kick on while watching video. Games result in an immediate whoosh of air though. That's to be expected from gaming laptops of course, and the Y7000 is admittedly less shrill than slimmer laptops like the Blade, but even so the fan noise was loud enough to be distracting. Invest in a decent gaming headset (go.pcworld.com/hdst).

My only remaining complaint: Rear ports. So many rear ports.

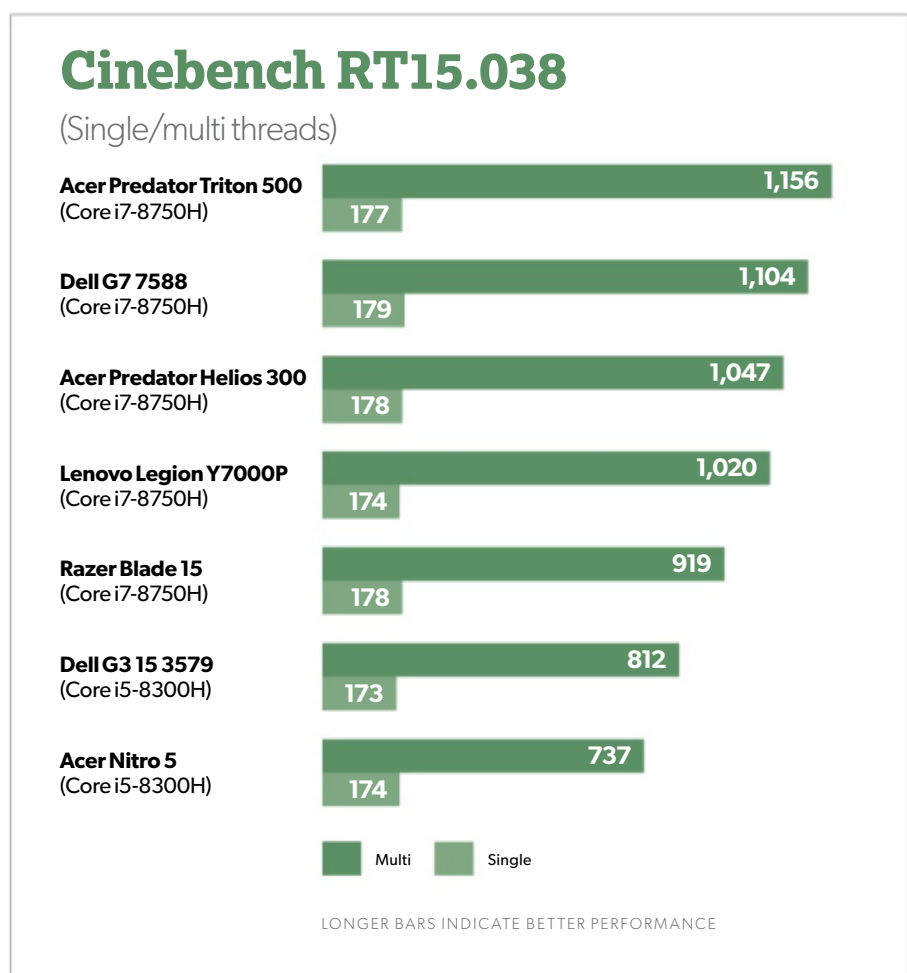
The Legion Y7000 has a 3.5mm jack on the left side, plus a single USB 3.1 port on both the left and right side. Everything else is on the back, including another USB 3.1 port, a USB-C port, HDMI and Mini-DisplayPort, ethernet, a lock, and the rectangular charging port. Rear ports are great if you plan to set your laptop up on a desk, as it's easier to hide the clutter. They're a pain when you want to use your laptop like an actual laptop though, and I prefer my inputs arrayed on the left and right sides with additional vents at the back.

PERFORMANCE

Mid-tier price, mid-tier performance. That's exactly

what Lenovo promised with the Legion Y7000 and exactly what it delivered when we ran it through our benchmark gamut. The GeForce GTX 1060 is a well-established piece of hardware at this point, and even the i7-8750H is familiar territory. The Y7000 put up the expected numbers against similarly equipped peers like the Acer Predator Helios 300 (go.pcworld.com/h300), and blew away the GTX 1050-equipped Lenovo Legion Y530 we tested last year.

First up is Cinebench, which measures a CPU's short-term performance. The Y7000's score of 1,020 won't turn any heads, nor does it



best the aforementioned Acer machine. It's well within the margin of error though, which is no surprise. These machines are basically identical, and thus put up basically identical scores. That's what you want to see, actually! It means there's nothing fundamentally wrong with the Legion Y7000, no aggressive throttling or heat-related problems to hunt down.

The same is true of our HandBrake test, which gives the CPU a lengthier task to complete. We re-encode a 30GB MKV file down to the "Android Tablet" preset, which takes about a half-hour on most modern gaming laptops, thus allowing us to measure how heat affects system performance. In the Y7000's case? Not much. In this case we see slightly higher scores than the MSI and Acer machines, though again the differences are negligible.

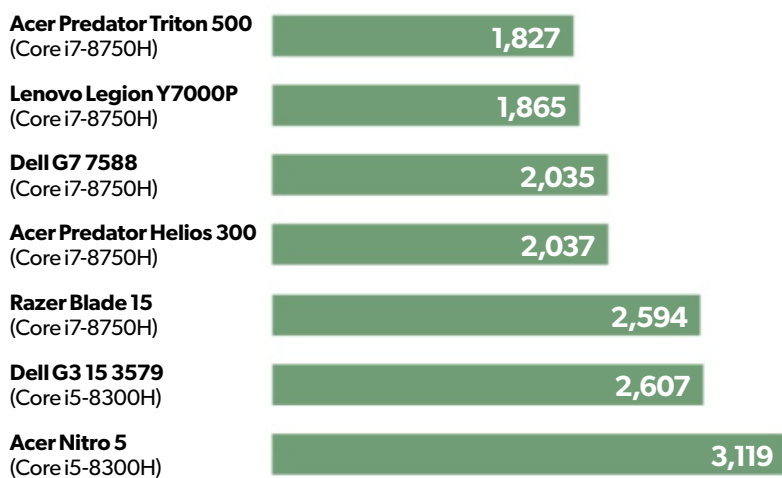
Moving onto the graphics performance, we first ran the Y7000 through 3DMark's FireStrike Extreme benchmark. This one's close enough you could probably

call it a tie, though the Acer Predator Helios 300 pulled slightly ahead.

And for real-world gaming performance, we tested the Legion Y7000 with both *Rise of*

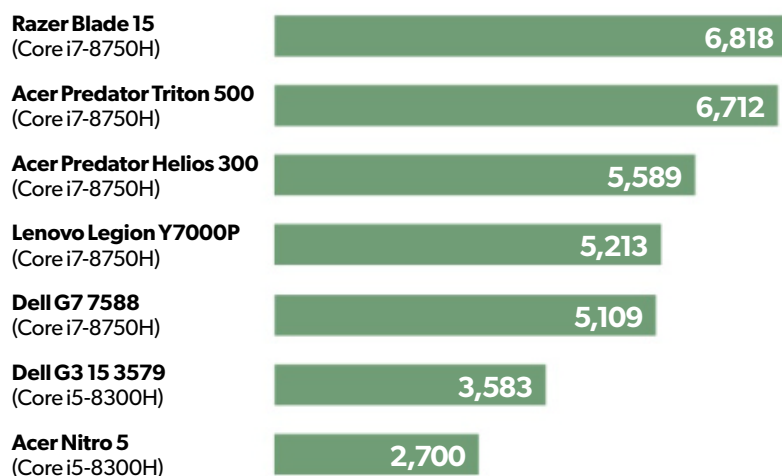
HandBrake Total Encode Time

(Seconds)



SHORTER BARS INDICATE BETTER PERFORMANCE

3DMark FireStrike Extreme 1.1 Overall (GPU score)



LONGER BARS INDICATE BETTER PERFORMANCE

the *Tomb Raider* and *Middle Earth: Shadow of Mordor*. Both these games are long in the tooth at this point, and a laptop like the Y7000 should easily handle these benchmarks, even with both maxed out at 1920x1080.

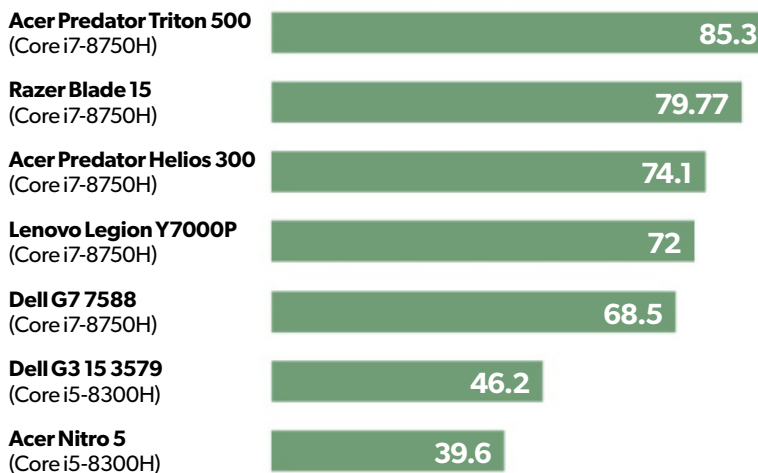
Indeed it did, putting up 72.0 frames per second in *Rise of the Tomb Raider* and 89.6 frames per second in *Shadow of Mordor*. You guessed it: Both are within the margin of error for a tie, compared with the Acer and MSI machines. And both are respectable, indicating that you're set to game at High or Very High presets for a few more years.

That said, it's worth looking at how large the jump is between the GTX 1060 and RTX 2060 machines. We recently tested a 2060-equipped Acer Predator Triton 500, and that put up scores of 85.3 and 120.1 frames per second in *Tomb Raider* and *Shadow of Mordor* respectively. That's a fairly significant gap, and of course the GTX 1060 is hardware at the end of its

lifespan while the RTX 2060 is just starting up. Given we also have a console refresh coming in the next few years, just be aware that any 1060-equipped laptop isn't as future-proofed

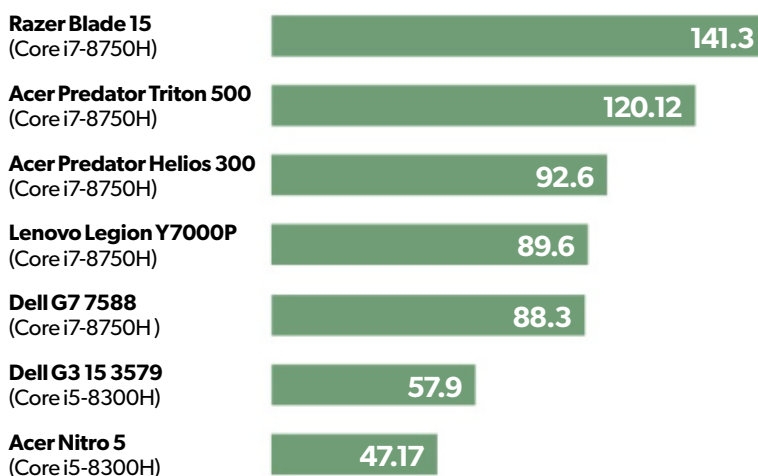
Rise of the Tomb Raider (2015)

(Fps)



LONGER BARS INDICATE BETTER PERFORMANCE

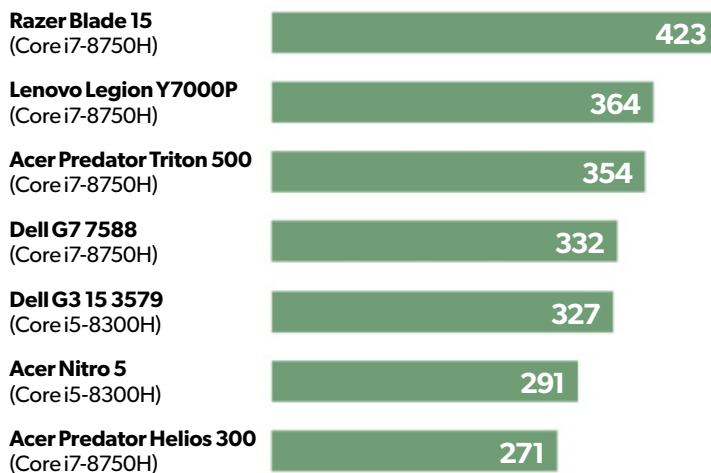
Middle-earth: Shadow of Mordor (Fps)



LONGER BARS INDICATE BETTER PERFORMANCE

Video rundown (battery life)

(minutes)



LONGER BARS INDICATE BETTER PERFORMANCE

all-around solid. For instance, the aforementioned Acer Predator Helios 300 is slightly cheaper and has a better display—but it's also bulkier, sports an edgier (or, if you're like me, uglier) red-and-black color scheme, and doesn't include the 1TB hard drive. And the MSI GS65 Stealth is far more portable, but retails for over \$1,500.

The Lenovo Legion Y7000 is a solid performer with an attractive design,

as you might like from an \$1,100 machine.

Lastly, our battery test. We typically run this at 250 nits, which the Y7000's 277 nit screen is *juuuust* capable of hitting. Once the display is set we loop a 4K video file, unplug the laptop, and wait for it to die. The Legion Y7000's 57 watt-hour battery went through this process in a little over 6 hours, which is excellent for a laptop of this type—though real-world gaming performance will undoubtedly rate lower. You're lucky if you get more than two to three hours of playtime from any gaming laptop.

BOTTOM LINE

It can be hard to stand out in the mid-tier gaming laptop market these days, but the Lenovo Legion Y7000 is certainly worth a second look from prospective buyers. There are other laptops with similar specs, but few as

great battery life, and a budget-friendly price. Lenovo's still probably not the brand you think of first when you think of "Affordable Gaming Laptops," but after the last few years? Maybe it should be. 🔌

Lenovo Legion Y7000



PROS

- Subtle-looking, at least for a gaming laptop.
- Great battery life.
- Fairly inexpensive.

CONS

- GTX 1060 isn't very future-proof.
- Screen is average.
- Noisy fans under load.

BOTTOM LINE

Lenovo's Legion Y7000 is a smart, sophisticated gaming laptop that will perform admirably for at least a few years—and at a competitive price point.

\$1,099



HP Spectre Folio: This lightweight leather laptop is different in a very good way

I can't take my hands off of it. It feels that good. **BY MELISSA RIOFRIO**

I can't take my hands off the HP Spectre. Lightweight and fully sheathed in leather, it feels great in a way that a metal- or plastic-clad laptop never could. Thanks to its energy-sipping Intel Core Y processor, it generates scant heat, and its battery lasts a very long time.

Of course, there are good reasons why we make computers out of hard materials that hold up well to use and abuse. That's why I spent several months using the Spectre Folio on trains, buses, and planes, in and out of my bag, and on and off my lap. The miles and hours were enough to prove any laptop.

The verdict? I'd gladly take the HP Spectre Folio anywhere. It's a thin-and-light laptop made even better with its unique looks and design, and unprecedented comfort.

No beauty comes without sacrifice, though. The Spectre Folio sacrifices some performance to keep its slender chassis cool, though it should be hard to notice if you stick to mainstream applications.

There's also one big unknown: how the leather will hold up over years. In the latter case, at least I can say that based on my experiences with the Spectre Folio and other high-quality leather products, I think reasonable care will keep it looking great.

PRICING AND SPECS

HP stuffed a surprising amount into the skinny Spectre Folio. The laptop has a starting price of \$1,300, and our review unit costs \$1,600 from HP.com Folio (go.pcworld.com/hpsp). As we run through the specs, we'll note options different from those in our review unit.

Shell: Full-grain leather, in Cognac Brown (our review unit) or Bordeaux Burgundy.

Display: 13.3-inch Full HD (1920x1080) IPS WLED backlit touchscreen with Corning Gorilla Glass 4 (our review unit). The



Yep, it's all leather from the lid to the base.

maximum brightness is a very nice 400 nits. A 4K UHD panel is a \$120 upgrade.

Graphics: Intel UHD Graphics 615 (integrated).

Memory: Starting at 8GB of LPDDR3-1866 SDRAM (16GB on our review unit).



The HP Spectre Folio sat very comfortably on my lap during a two-hour train trip. Note I'm in no need of the AC outlet by my seat.

Storage: 256GB PCIe NVMe M.2 SSD.

Networking: Intel 802.11b/g/n/ac 2x2 Wi-Fi and Bluetooth 4.2 combo with MU-MIMO support. Our LTE review unit has two e-SIM slots under the display hinge.

Camera: Front-facing HP WideVision FHD IR webcam .

Pen: HP's battery-powered Pen comes standard. The Tilt Pen, which recharges via USB-C, is an \$80 option.

Ports: Two USB 3.1 Gen 2 (10Gbps)/Thunderbolt 3, one regular USB 3.1 Gen 1 (5Gbps) Type-C, and one 3.5mm audio jack. Sorry, no HDMI, ethernet, or SD card support (for those, check out our USB-C hub buying guide).

Battery: 6-cell, 54.28Whr lithium ion polymer. HP estimates 12.75 to 21 hours of life. Your mileage will vary, especially if you crank up the screen brightness or buy the LTE model.

Dimensions: 12.6 x 9.23 x 0.6 inches.

Weight: 3.24 to 3.28 pounds, depending on the model.

THIN IS IN

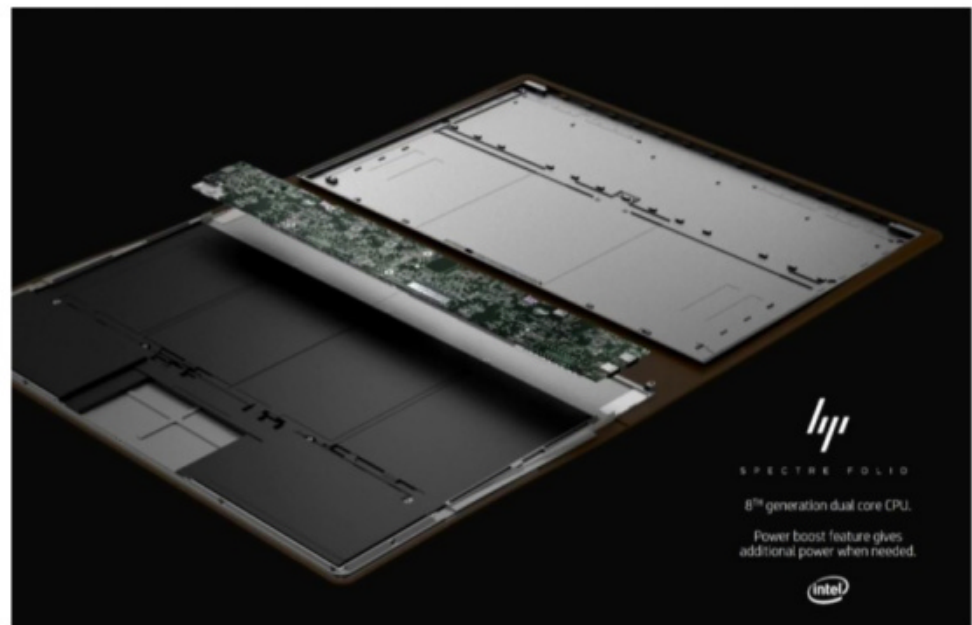
HP worked hard to make the Spectre Folio so thin. As I detailed in my hands-on with the

Folio (go.pcworld.com/flho), the bottom consists of an aluminum panel bonded to the keyboard tray. HP used lighter magnesium under the leather lid so the laptop wouldn't be top-heavy.

The full-size, island-style keyboard has 1.3mm of travel—pretty good for something this thin, and comfortable during my many hours with it. The keys are completely flat, and slightly matte so they aren't too slippery (but they do show greasy fingerprints).

I'm not a fan of clickpads, but the Spectre Folio's works fine. It's a little small, and color-matched to the leather.

The speakers, designed with audio company Bang & Olufsen, lie underneath a fine grillework above the keyboard. Like most laptop speakers, they sound tinny on their own, but they achieve impressive volume.



The HP Spectre Folio has an aluminum panel on the bottom and magnesium on the top. The slender motherboard nestles above the keyboard.

Headphones unleash better quality from the audio subsystem.

The motherboard is a mere strip running underneath the speakers, the result of a close partnership between Intel and HP (go.pcworld.com/hpin). If you get the LTE

version, the antenna is built into the top of the lid to avoid interference from the motherboard.

Having achieved thin and light, let's see how the Spectre Folio builds upon those qualities with its unique leather casing.



The keyboard has 1.3mm of travel, not bad for a laptop this thin.



Intel partnered with HP to make the teeny motherboard for the Spectre Folio, a mere strip running along the top of the keyboard.

WHAT IT'S LIKE TO USE A LEATHER LAPTOP

To those who'd ask, "Why would you ever build a laptop out of leather?" it's fair to reply, "Why not?" We already use leather for shoes, bags, athletic equipment, and riding tack because it's durable and flexible. The Spectre Folio's leather was made with a chrome-based tanning process that is also used for car seats. It's stain- and water-resistant, with a pebbly texture.

HP advises taking care of the Spectre Folio just as you would a leather jacket or handbag. And notably, most of HP's care instructions (go.pcworld.com/hand)—such as cleaning with a soft cloth, and avoiding harsh chemicals and abrasive surfaces—would also apply to a hard-shell laptop.

But there's also a somewhat less intuitive caution: "HP does not recommend applying leather protectant or sealant products."

I carried the Spectre Folio in a laptop bag, as I would with any laptop, and I treated it just like any laptop. After several months of use, it still looks like new. I also appreciate how the Spectre Folio's surface is easy to grip and doesn't show fingerprints. The glued edges of the leather are potentially the weakest point, but so far they've held strong.

My experience when the Spectre Folio is actually on my lap seals the deal. The leather is soft and breathable, and its texture makes it less prone to sliding off my knees.

I also can't overemphasize the aesthetic and sensual aspects of the Spectre Folio's exterior. Cold, hard metal or plastic has nothing on the warmth and beauty of leather. HP even designed a little stitching into the lid and the pen loop to evoke handmade goods.

One of the few, minor hassles I

experienced was in port accessibility.

Because the leather edges overhang each side a bit, I kept hitting them with my cable connector as I aimed for a port.

DOES A LEATHER LAPTOP GET HOT?

Many readers have asked whether the Spectre Folio gets hot. It's a good question because the fanless laptop has almost no ventilation—just a long, open channel (see above) where the leather loosely covers the hinge between the lid and the keyboard.

I rarely keep traditional laptops on my lap for extended periods because they generate too much heat. But the Spectre Folio is the opposite: comfortably cool the vast majority of the time.

It got noticeably hotter on a couple of random occasions, after extended use. I measured it with a FLIR sensor at 109.8 degrees Fahrenheit, concentrated (not

surprisingly) over the CPU. HP confirmed this reading to be "within tolerance." The Spectre Folio's dismal performance in our HandBrake CPU test (see our Performance section, below) suggests that, overall, the laptop sacrifices performance to stay cool. There's even a "Cool" mode you can set via the system BIOS (a "Balanced" mode is the



The leather edge made ports a little hard to access.



This FLIR heat sensor map shows the hot spot that developed occasionally around the CPU on the HP Spectre Folio's slender motherboard.

Intel's low-power display technology (LDPT), which runs on as little as 1 watt of power (up to 1.5W-1.6W at maximum brightness), compared to 2 watts for a typical non-LPDT display. This frugal design helps achieve the Spectre Folio's long battery life.

The screen design is unusually versatile. It attaches only to the top part of the lid, with a hinge in the middle,

default), but we'd guess performance would take a big dive if you did so.

THE INNOVATIVE DISPLAY

The Spectre Folio's 13.3-inch touchscreen is bright and crisp with wide viewing angles, but there's a lot more to it. For one, it uses

and gentle magnets at the bottom. You can flip it out from the middle partway into a tentlike viewing mode, or completely flat to use like a tablet. Notice that in tablet mode, the flipped display covers the keyboard, so you don't have that weird upside-down keyboard situation of most convertibles.



The HP Spectre Folio's display moves from clamshell to viewing to tablet modes.

The first few times you use the display, you might flip it outward accidentally, especially if you grip it from the side. The flip is harmless, but it momentarily looks like the display has broken off. If you grip it from the top, it transitions smoothly.

The Spectre Folio bundles an HP Pen. It has 1,024 levels of pressure, which HP interpolates via firmware to 4,096 levels. It attaches to the Spectre Folio using a stitched-leather pen loop that you apply permanently into a special slit in the chassis. Open pen loops are a bit of a hassle, but they're better than nothing.

PERFORMANCE

Let's be clear: The Spectre Folio offers competent mainstream performance, but it's not a workhorse laptop, let alone a gaming laptop. A fanless design in such a thin package demands that the Folio sacrifice speed to control heat, and this shows in certain tests.

We compared the Folio to similar convertible-slash-2-in-1 laptops, where the display rotates (such as with Samsung's Notebook 9 Pen [go.pcworld.com/n9pn]), or where it detaches (such as with Microsoft's

PCMark 8 Work 2.0 Conventional

(Native resolution)

Samsung Notebook 9 Pen (Core i7-8550U)	3,474
Dell New XPS 13 9370 (Core i5-8250)	3,460
Lenovo IdeaPad Miix 520 (Core i5-8250U)	3,409
HP Spectre Folio ak0xxx (Core i7-8500Y)	3,302
Microsoft Surface Pro 6 (Core i5-8250U)	3,077
Microsoft Surface Laptop 2 (Core i5-8250U)	2,860

LONGER BARS INDICATE BETTER PERFORMANCE

The HP Spectre Folio posted a solid score of 3,302 in PCMark Work 8 Conventional, meaning it will handle mainstream applications just fine.

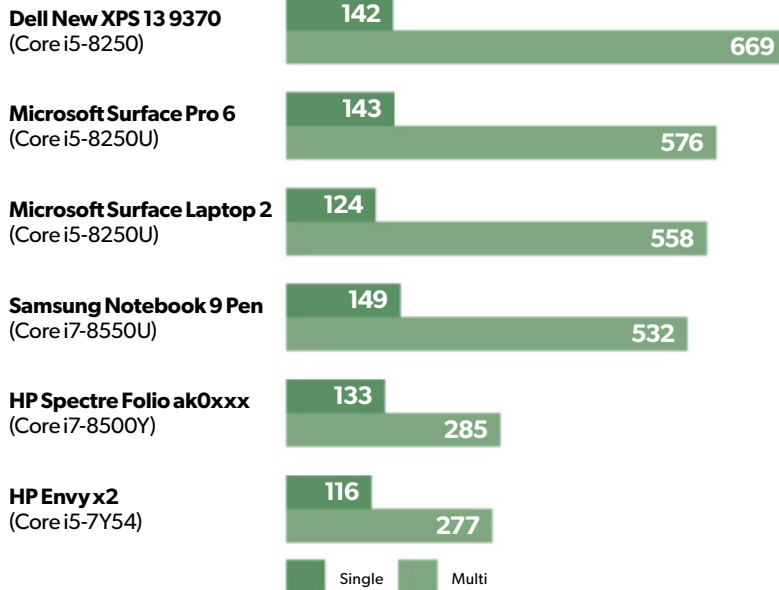
Surface Pro 6 [go.pcworld.com/sfp6]). We also tried to restrict our comparisons to a certain class of CPU. We haven't tested anything else with the Spectre Folio's dual-core Core i7-8500Y chip, so we include an HP Spectre x2 with an earlier dual-core Core i5-7Y54 processor, and a bevy of models with the widely used Core i5-8250U or Core i7-8550U.

While the latter two have the inherent advantage of being quad-core, the Core i7-8500Y's high 4.2GHz maximum turbo frequency helps a lot. The Core i5-8250U has a 3.4GHz max, and the Core i7-8550U tops out at 4GHz (while the Core i5-7Y54 lags at 3.2GHz).

PCMark Work 8 Conventional tests performance in mainstream computing. A

Cinebench RT15.038

(Single/multi threads)

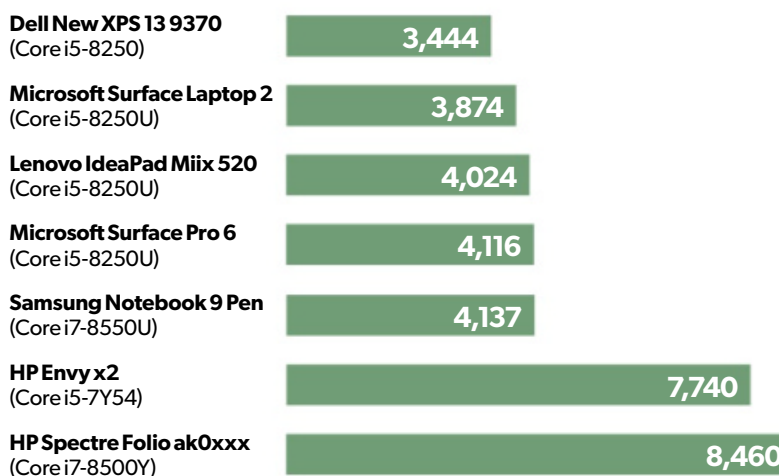


LONGER BARS INDICATE BETTER PERFORMANCE

The HP Spectre Folio will ably run typical single-threaded applications. The result for multi-threaded tasks confirms what we already know: It's not a high-performance machine.

HandBrake Encode 0.99.0

(Seconds)



SHORTER BARS INDICATE BETTER PERFORMANCE

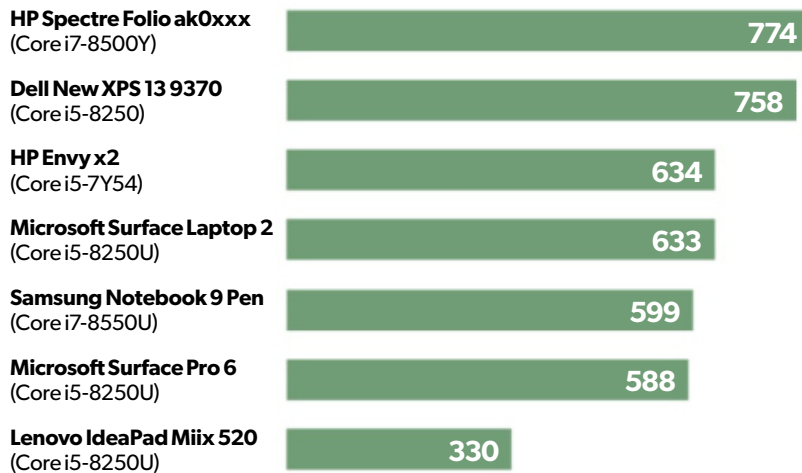
score of 2,000 or higher on this test is all you need, and the Spectre Folio clears that.

Maxon's Cinebench R15 is a free CPU benchmark, which we run in both single- and multi-threaded loads. The vast majority of software and games rely on just one or two threads, so the Spectre Folio's solid performance here is what matters. The Spectre Folio's multi-threaded result is limited by its dual-core architecture.

A typical laptop struggling to dissipate heat will throttle CPU speed to compensate. We often see that during the prolonged run of our HandBrake test. We set the utility to transcode a 30GB 1080p MKV file using the built-in Android Tablet preset. Given the HP Spectre Folio's design tradeoffs, its lackluster score is no surprise.

Video rundown (battery life)

(minutes)



LONGER BARS INDICATE BETTER PERFORMANCE


The HP Spectre Folio lasted nearly 13 hours in our video rundown test, meaning you can abandon your AC adapter for the day with confidence.

BATTERY LIFE

Where the Spectre Folio shines is in battery life. We charge the battery to full, set the display to 250 nits' brightness and the volume to midrange (with earbuds connected). With the laptop in airplane mode and off AC, we loop a video until the machine dies. It lasted nearly 13 hours in our test. This is on the low end of what HP promises, but it's still plenty. I left the AC adapter at home, and gloated about it to my coworkers.

BOTTOM LINE

While I love the HP Spectre Folio's leather casing, that's just part of why this laptop rates highly. Without the leather, it would still be remarkably lightweight, cool, and long-lasting on battery. With the leather, HP's added feelings to the laptop—feelings of

comfort, luxury, naturalness. Those are good feelings to have, and they just might sell you on the Spectre Folio. 

HP Spectre Folio 13t



PROS

- Leather-wrapped chassis is lightweight, comfortable and durable.
- Innovative display design makes it easy to convert from clamshell to tent to tablet modes.
- Rarely gets too hot to keep on your lap.

CONS

- Leather edges get in the way of side ports.
- CPU performance suffers in the quest for cooler temperatures.

BOTTOM LINE

Lightweight and leather-wrapped, the HP Spectre Folio actually feels comfortable, in a way that a metal- or plastic-clad laptop never could. Thanks to its energy-sipping Intel Core Y processor, it performs capably while generating very little heat, and its battery lasts a very long time.

\$1,600



WD Blue SN500 NVMe SSD: Great bang for the buck

Good performance (even off cache) and a very nice price make this the entry-level drive to buy. **BY JON L. JACOBI**



It doesn't seem that long ago that the scoop was, "NVMe is great, but it's gonna cost you big time." Now, thanks to drives like WD's new Blue SN500 (available on Amazon [go.pcworld.com/blue]), price isn't that big of an issue. At least not when you consider the 4X boost in speed it delivers. For most users, not having to wait for their computer anymore is worth a little extra cash.

The Blue SN500 itself is a good performer that holds firm on long writes, unlike much of the similarly-priced competition. It's certainly a kick in the pants compared to SATA.

DESIGN AND FEATURES

As with all NVMe drives for mainstream machines, the Blue SN500 uses the M.2

connector and is 22 millimeters wide. Also like the majority, it's 80 millimeters long. You get the occasional shorty, such as Toshiba's RC100 (go.pcworld.com/rc10), but 80mm is the norm. It's PCIe 3.0 x2, which limits maximum throughput to 2GBps. We didn't see quite that, but since SATA is only about 550MBps, that's still fast compared to what many are used to.

The SN500 uses 64-layer TLC NAND, with some of that utilized as SLC cache. Roughly one percent (see the performance section.) There's no DRAM cache, but the drive performs well without it.

Note that there are a whole lot of legacy systems out there that don't support booting from NVMe. You can employ NVMe SSDs using a \$25 adapter card as superfast secondary storage in nearly any system, which can be of

benefit if you're working with heavy-duty video or audio applications. But without the ability to boot from NVMe, you won't get the overall system snappiness it's capable of providing.

PERFORMANCE

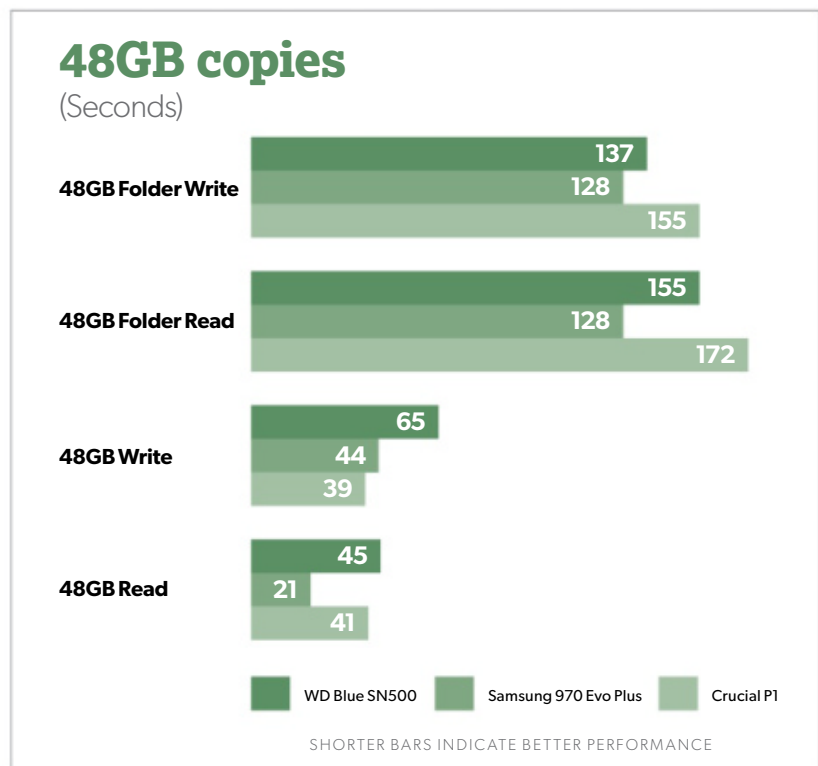
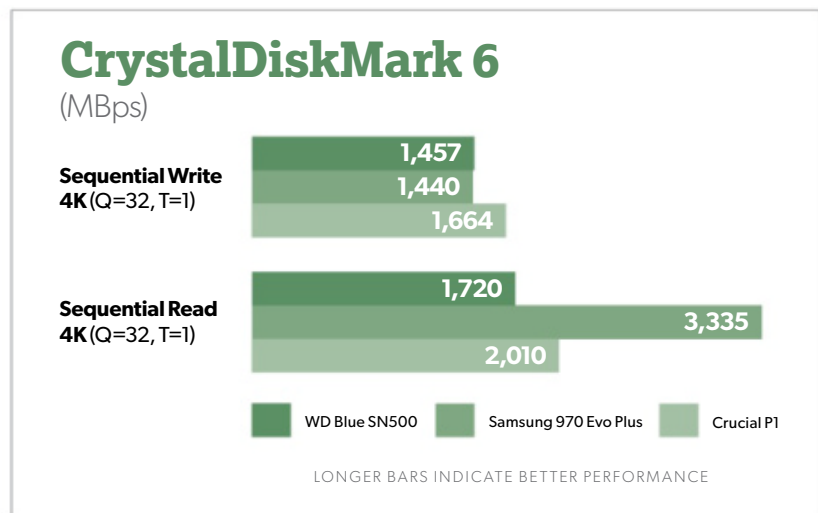
The Blue SN500's closest competitor in both price and performance is Crucial's P1, which it beat in some tests, and lost in others. But keep in mind that all NVMe drives have ridiculously fast seek times, which makes the slowest of them seem fast in comparison to SATA, at least until you write large amounts of data. There, the 500GB version of the SN500 that I tested held its own.

With less cache (some of the TLC is treated as SLC by writing only a single bit instead of three), the 250GB version (available on Amazon [go.pcworld.com/sn50]), for which WD claims roughly the same performance, will drop in write speed sooner than the 500GB version. The 500GB model ran out of cache at about the 10GB mark during our 48GB write test.

Note that I only included drives that are cost competitive with the Blue SN500. There are much faster drives out there such as WD's Black SN750 NVMe (go.pcworld.com/

[wd75](http://go.pcworld.com/smp)) and of course, Samsung's 970 Pro (go.pcworld.com/smp), the crème de la crème.

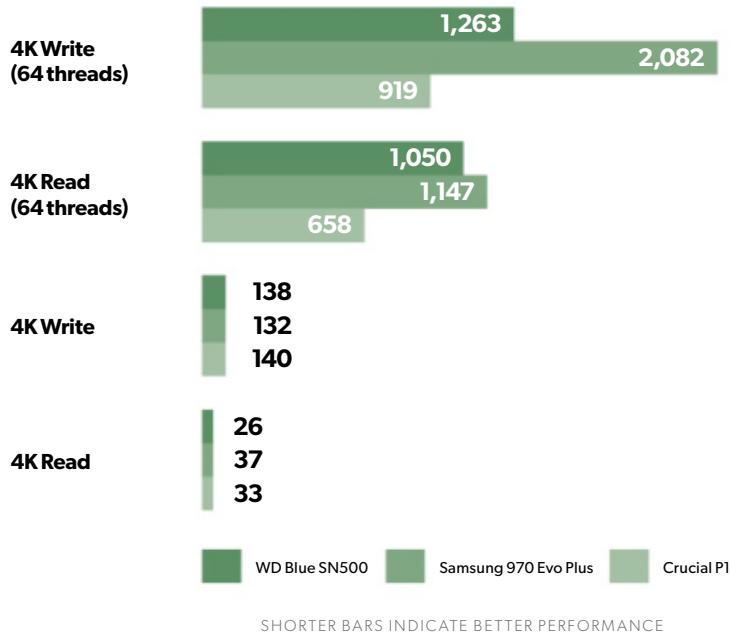
As you can see, the SN500 did quite well with smaller files and folders, but ran out of cache fairly early, dropping sustained write



The Blue SN500 did well in the smaller file and folder tests, but lagged behind the Crucial P1 writing our single large 48GB file.

AS SSD 2.0 4K Performance

(10GB/MBps)



speeds to 750MBps. This resulted in a somewhat lethargic single file write time—for NVMe.

The SN500 did well in CrystalDiskMark, though it couldn't match Samsung's 970 EVO. Note that both competitors were 1TB drives with more cache. The 970 EVO slows down similarly once it runs out of SLC cache.

4K performance is indicative of how fast a drive can write or retrieve lots of small files, which requires lots of seeks and stresses the controller. Here again the more expensive Samsung 970 EVO rules, though the Blue SN500 did quite well compared to other budget drives.

Considering that the Blue SN500 is leveraging only two PCIe lanes and has no DRAM cache, it performed very well in our

tests: largely on a par with the Crucial P1, but without the drastic drop in write speeds that hits that drive after it's exhausted its very generous cache. Good job, WD (and SanDisk—the company WD bought for its NAND savvy.)

BOTTOM LINE

The Blue SN500 isn't the fastest NVMe drive out there, but it's certainly fast enough for the average user, and the price is right. At the capacities it's available in, I recommend it over the Crucial P1, which suffers a severe slowdown on those rare occasions when it runs out

of cache. Hopefully, a 1TB model is in the works, as the limited capacity (by today's standards) is the one thing that would keep me from installing a Blue SN500 in my own computers. 🛑

WD Blue SN500 NVMe SSD



PROS

- Excellent bang for the buck.
- Maintains 750MBps write speed when cache is exhausted.

CONS

- Only available in 250GB and 500GB capacities.

BOTTOM LINE

Even WD's bargain NVMe SSDs provide excellent bang for the buck. Unlike some cheap competitors, the Blue SN500 maintains a reasonable 750MBps write speed when it runs out of cache. That alone makes it our favorite entry-level NVMe SSD.

\$64



The Sinking City hands-on preview: Like Sherlock Holmes, but weird

Sherlock Holmes? More like Shock-ler...Bones. I tried. **BY HAYDEN DINGMAN**

Oakmont, Massachusetts, is drowning. Fully half the city has been abandoned to the sea, bustling city streets now replaced by rivers, winding between the sagging wooden edifices of lost storefronts. Problem is, I need to get into one of those shops. A diving crew's gone missing, the only known survivor's gone mad, and I've been charged with finding out whether the rest are

alive or not—and the workshop that made diving suits is on this block somewhere.

Sighing, I clamber into a nearby rowboat and hope that the top levels have survived relatively unscathed. I'll tell you what, Sherlock Holmes never had it this rough.

STARING INTO THE ABYSS

The Sinking City (go.pcworld.com/sink) is more ambitious than I imagined. When the

project was announced—back when it was still a *Call of Cthulhu* game—I expected developer Frogwares to turn out one of its *Sherlock Holmes* games with a cosmic horror bent. And that would’ve been fine! The *Sherlock Holmes* games all follow the same basic case-by-case structure, but they’re (with the exception of 2016’s *Devil’s Daughter* [go.pcworld.com/dvil]) also fairly enjoyable detective games. Easy, but enjoyable (go.pcworld.com/crpn).

Frogwares has quietly come into its own though. Writing about *Crimes and Punishments* in 2014, I said the *Sherlock Holmes* games had gone from guilty pleasure to “legitimately good,” in part because of improvements on the technical side. *Devil’s Daughter* was by-and-large disastrous from a story and structure standpoint, but continued to push for larger and better-looking environments.

And in *The Sinking City* that process culminates in an enormous open-world, with crowded city streets and seamless interiors. It’s nothing we haven’t seen before, but it’s definitely something we haven’t seen from Frogwares before.

The effects are far-ranging.



I had the chance to go hands-on with *The Sinking City* for about two hours last week, and I should caution up-front: They wanted me to stick to the main storyline for the demo. There are a ton of side-missions, some of which I saw hints of during the demo. You can tackle these in any order, simply by following rumors to a location on the map. But how long they are? How involved? I don’t know yet.

We went straight through the first two cases in the game though: The disappearance





of local politician Robert Throgmorton's son and then the aforementioned diving expedition. And even without wandering off in search of side missions, the open city influenced these cases in myriad ways.

The Sinking City is loathe to tell the player where to go, for instance. You'll (very) occasionally get a quest marker, but often you need to pay attention to verbal directions or infer your next destination from context.

The first case, Throgmorton told me his son had washed ashore in a rowboat. Asked where that happened, he told me to face the door of the warehouse, then head left until I found a fenced-in beach. That was it. No quest marker, nor even a point-of-interest marked on the map. I just had to walk. The rowboat contained a

vital piece of evidence, and I'm not sure what would have happened if I missed it—assuming *The Sinking City* allows you to miss it. I didn't get to test that hypothetical either.

Regardless, it's neat to play a detective game that doesn't hold the player's hand all the time. Told to head to a local dive bar, I had to wander the docks until I found it. Another locale indicated a wounded man fled the crime scene, and I inferred that I should head to the hospital. Once there, I had to



ascertain which of the new arrivals seemed most likely to be lying about an axe wound to the shoulder. And in the case of the diving suit I was told the shop's cross-streets, enough to place my own marker on the map.

The Sinking City

shines in these moments.

You feel like an actual detective, crisscrossing Oakmont in pursuit of various leads, each clue revealing the existence of others until you can chain together a full account of the crime. It's those *Sherlock Holmes* games, but on a much larger scale. The second case in the game took me upwards of an hour to complete and involved the local newspaper, an adventurer's society, a fight at the docks, the hospital, the diving suit warehouse, a brief underwater section, and a large undersea cavern and/or temple. *Cthulhu* fans know what's coming.

Anyway, I've listed seven distinct locations there, each with clues to the case and the world itself. Unfortunately the crime scenes are a bit more rote—the points of interest are usually pretty obvious, and *The Sinking City* tells you when you've found every clue in an area. It feels a bit like *Murdered: Soul Suspect* I think, which is disappointing considering how subtle *The Sinking City* is at other times.



But as I said with the rowboat, I'll be curious whether the player can miss entire investigation areas and thus miss out on crucial evidence. That could be a neat twist.

Frogwares also brings back the *Sherlock Holmes* deduction web, which allows you to come to improper conclusions about evidence. And on top of that, there are a number of choices to be made about your conclusions. In the first case I cornered the killer, but he claimed he'd been possessed during the murder. He also offered a bribe, if I looked the other way. My options? Turn him in to Robert Throgmorton, or don't and take the bribe—or take the bribe, then turn him in.

It seems like *The Sinking City* is setting up for some fairly complicated faction storytelling, with the Throgmortons and their political strength on one side and the Innsmouthers—fish people, in classic Lovecraft tradition—on the other. I'm looking forward to seeing how that plays out too.

Again, it's very ambitious compared to what Frogwares has done before.

Not that all the rough edges have been sanded off. There was some shooting in my demo, basic combat against skittering spider-like creatures. That aspect wasn't very inspiring, and I'm hoping it doesn't become a major part of the game going forward.

Your character also hallucinates when his sanity meter drops, à la *Call of Cthulhu: Dark Corners of the Earth*, but early in the game this system hasn't seemed very important. There was one good moment where I shot one of those nightmare-spiders, only for it to disappear in a puff of smoke, a figment of my imagination. That was an outlier though. Most of the time my "insanity" manifested as grainy images of our poor private investigator protagonist hanging from a

noose, which was grisly but not very interesting or surprising. Here's hoping *The Sinking City* can reach the heights of cult favorites like *Dark Corners of the Earth* and *Eternal Darkness*.

BOTTOM LINE

I've been looking forward to *The Sinking City* for a while though, and getting hands-on time only made me more excited. Nobody else makes detective games on this scale. There's bound to be some jank around the edges, but if Frogwares can nail the core cases and make good on its more open structure I think *The Sinking City* will be something special.

As I said, Frogwares has certainly come into its own over the last few years.

Impressive. 

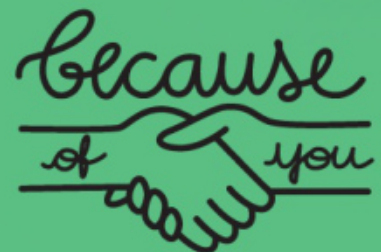


BECAUSE YOU
WERE THERE
FOR ME WHEN
I HAD NO ONE,
I STARTED
LOVING
MYSELF AGAIN.

Kailee M.



Everything you say and do
creates an impact.
becauseofyou.org



USB

4

IT'LL SOLVE A FEW PROBLEMS. BY GORDON MAH UNG

WHAT THIS FUTURE
STANDARD MEANS
FOR USB CHAOS &
THUNDERBOLT 3

ILLUSTRATION
BY PETE RYAN







Now that the upcoming USB4 spec promises to “adopt the Thunderbolt 3 protocol,” there’s some hope it means an end to our international nightmare of USB confusion. You know, the one where there are:

- Two different connectors: USB-A or USB-C
- Four different active specs: USB 2.0, USB 3.0, and USB 3.1 Gen 1 and Gen 2
- Scarce Thunderbolt 3 support, despite using the same form factor as USB-C
- An upcoming USB 3.2 spec that precedes USB4 and introduces yet more confusion through clumsy rebranding

Yeah. That nightmare.

More likely, even when USB4 is fully implemented around 2021, confusion will linger. You can’t blame the USB Implementers Forum (USB-IF) and the USB Promoter Group (USB-PG) either, tempting though it is. They are organizing groups that ratify standards and help certify hardware. With literally tens of thousands of vendors making USB devices, it’s akin to herding cats. And because USB goes into everything from five-cent USB keys to \$50,000 servers, the group says it has to leave it up to vendors to choose what’s best for the product.

On the other hand, vendors don’t always

make decisions that make sense to consumers. Take the blue USB Type-A ports, which should have easily denoted the then-new 5Gbps USB SuperSpeed support, rather than the older black USB 2.0 ports. While most PC vendors adopted the blue as they were “encouraged” to do, some vendors stuck with black because—we kid you not—it looked better. In the end, we got a rainbow of USB Type-A ports that indicated nothing.

We’ll help you decipher what the USB landscape is today and where it’s headed with USB4. We’ll start with some short answers for what you need to know, then follow with more detail if you want to dive deeper.

What’s a specification? A specification, such as the USB4 specification, is a document that describes a technology and how to implement it, and is something that’s been agreed upon by a standards group or trade group. All manufacturers of the product are expected to follow the specification, though they may choose to follow only parts of it (this is where the confusion starts with USB).

What’s a protocol? A protocol, in the context of USB connectivity (and networking in general), is a term that describes how two devices communicate with one another. The protocol may describe the nature of the data and how it is sent, and also what the physical delivery system is (usually a cable). A protocol may be released as an entire specification, or be part of a specification. When we say that

USB4 will incorporate the Thunderbolt 3 protocol, it means that Thunderbolt 3–connected products will be able to work through USB4 ports—assuming the vendor implements the support, and assuming an appropriate cable is used. Oh sorry, was that confusing?

What is USB4? It’s a new specification for a future generation of USB connectivity (think 2021 and beyond). USB4 promises to simplify to one connection type (USB-C) and be capable of up to 40Gbps transfer speed. It’s the next step after USB 3.2, which is coming soon.

You may be wondering why it’s called USB4 rather than USB 4.0. The USB-PG is going with that spelling, at least for now. The belief is the public and press became too fixated on that decimal point in USB 3.1 and USB 3.0, instead of focusing on the capability and purpose of the spec.

What is Thunderbolt? Thunderbolt (TB) is an Intel technology that was intended to be “one cable to rule them all,” whether you wanted to connect an external drive, hook up a display, or charge a smartphone. The reason it’s not ruling them all yet is because Intel kept tight control of the technology, making implementation expensive and therefore undesirable for many PC makers.

The current iteration, Thunderbolt 3, has a data transfer rate of up to 40Gbps. It bundles PCIe, USB, and DisplayPort data, along with the capability to send up to 100 watts of



Thunderbolt 3 and USB4 aren't the same, just closely related.

power to charge a small device, such as a smartphone. Its connector uses the same form factor as USB-C, but unless your USB-C port is also a Thunderbolt port, Thunderbolt devices won't work with the port.

Is the USB4 spec the same as the Thunderbolt 3 spec? Not really. USB4 provides support for Thunderbolt 3, but whether a certain USB4 implementation supports it will be up to each manufacturer.

Is the USB protocol the same as the Thunderbolt protocol? Currently, no. USB signaling protocols have been on their own path since USB was first introduced in 1996. Intel and Apple introduced Thunderbolt in 2011, and it essentially carries PCIe signaling for most of its data transfer purposes.

In real-world terms, it boils down to having the right cables and ports for the job. If your USB 3.1 Gen 2, USB 3.2, or USB4 port supports Thunderbolt 3, you can connect a

Thunderbolt 3 device to it, provided the cable also supports Thunderbolt 3. Cables that support USB data transfer, but not TB data transfer, won't work.

What's the short version of what I need to know about USB4 and Thunderbolt 3? USB4's embrace of Thunderbolt 3 may mean less confusion about what works with what. However, it's still up to the vendors to implement the spec, and it's possible some Thunderbolt 3 devices will be left in the cold. For more details, keep reading.

HOW THUNDERBOLT 3 AND USB4 RELATE (SOMETIMES)

To understand how Thunderbolt and USB work together (or not), it helps first to explain how USB's different spec generations work together. Backward compatibility is one of USB's advantages, but also one of its challenges, as it by definition defers to the lowest common denominator. The USB chart on page 83 will show you each spec version, its maximum data transfer rate, and the connector type it supports—the boxy USB-A, or the curvy USB-C.

Newer, faster USB devices will work with older, slower ports, but only at the older speed. Similarly, older, slower USB devices will work in newer ports, but only at the old speed. The same goes for the cables that

connect the devices to the ports: The cables may support a certain speed, but ultimately the port's speed rules.

All Thunderbolt 3 ports in a PC support SuperSpeed 10Gbps speeds (USB 3.1 Gen 2). They should do the same for the upcoming USB 3.2.

Where it gets downright messy is with Thunderbolt 3 drives. Plug a Thunderbolt 3 drive enclosure into a Thunderbolt 3 port with a 40Gbps Thunderbolt 3 cable, and in theory you get your 40Gbps-or-so (40Gbps in each direction shared across PCIe and DisplayPort). But take that same drive and plug it into a USB port that doesn't support Thunderbolt 3, and you'll get nothing. Most of the chipset controllers in the drive enclosures do not support USB over the Thunderbolt 3 port, even if the PC does.

To get around this, most drives (such as

Akitio's Thunder 3 Duo) add backward compatibility with USB-only PCs by including a separate USB SuperSpeed 5Gbps port on the drive with its own controller.

Alternatively, Intel's new Titan Ridge Thunderbolt 3 controller adds native USB SuperSpeed 10Gbps to the actual USB-C port in the drive enclosure. You should be able to plug a USB-C connector cable into any Titan Ridge enclosure, and then just plug it into either a Thunderbolt 3 port in a PC or any other USB-C port in a PC.

With USB4, you get a melding of the two in a unique USB protocol that carries USB packets, Thunderbolt 3's PCIe packets, and DisplayPort packets. In theory, this is probably the ultimate vision of "one port to rule them all."

Unfortunately, this doesn't mean that all USB4 ports will support Thunderbolt 3.

Remember, the USB-IF can only politely "encourage" vendors, the same way you'd encourage a guest to take their shoes off when they enter your house, or wash their hands after they use the bathroom.

The USB-IF and USB-PG believe most manufacturers will implement the full spec, because any device that needs the high-speed modes of USB4 would most likely support the legacy Thunderbolt 3. Still,



Like most drives, Akitio's Thunder 3 Duo Pro features Thunderbolt 3 ports. Its USB mode must use a separate USB cable.



Devices such as the Google Pixel 3XL and future iterations really don't need the high-speed capability of USB4, so they probably won't carry the full 40Gbps data rates.

compliance will likely depend on the device. A \$250 budget laptop or a smartphone could be dicey. A \$1,900 rose-gold laptop likely will, because the laptop maker knows high-end buyers are looking for high-end features such as eGPU support.

HOW USB4 AND THUNDERBOLT CABLES WILL WORK (OR NOT)

We have to wait for the final USB4 spec to know how the cable situation will sort out, but this is what we think will happen.

Passive Thunderbolt 3 cables (ones without a controller) are typically a maximum of 18 inches in length and can transfer up to 40Gbps. Most will also work to carry USB signaling when plugged into a laptop or phone without Thunderbolt 3. You can push

a passive cable's length to two meters, but the top speed drops to 20Gbps.

If you need a Thunderbolt 3 cable that stretches longer than that without losing more speed, you need an active Thunderbolt 3 cable (with its own controller). Active Thunderbolt 3 cables cost about three to four times that of similarly long USB-only cable, and are limited to only 480Mbps (USB 2.0) for USB transfers.

When USB4 comes along, a passive Thunderbolt 3 cable that

is essentially a really high-quality USB-C SuperSpeed cable should (we say *should* because the spec is not finalized) hit SuperSpeed 10Gbps or SuperSpeed



The cable in the middle is a Thunderbolt 3 cable. One of the other cables is also Thunderbolt 3-capable while the other is a USB-only cable. Clear as mud, yes?

CABLE TYPE	IN THUNDERBOLT 3 PORT	IN SUPERSPEED USB (USB 3.0 GEN 1) PORT	IN SUPERSPEED USB 10GBPS (USB 3.1 GEN 2) PORT	IN SUPERSPEED USB 20GBPS (USB 3.2 2X2 SPEC) PORT	IN USB4 SPEC PORT
<0.8 meter Passive Certified Thunderbolt 3	Up to 40Gbps (depends on cable quality)	Up to 5Gbps	Up to 10Gbps	Up to 20Gbps (depends on cable quality)	Up to 20Gbps (Probably)
>0.8 meter Passive Certified Thunderbolt	Up to 20Gbps	Up to 5Gbps	Up to 10Gbps (depends on cable quality)	Up to 20Gbps (depends on cable quality)	Up to 20Gbps (Probably)
Active Certified Thunderbolt 3	Up to 40Gbps	Up to 480Mbps	Up to 480Mbps	Up to 480Mbps (Probably)	Probably won't work
Certified USB-C SuperSpeed	Up to 10Gbps in USB mode. may or may not work with Thunderbolt 3 mode	Up to 5Gbps	Up to 10Gbps	Up to 20Gbps (Probably depends on cable quality)	Up to 20Gbps (Probably depends on cable quality)
40Gbps Certified USB4	Probably up to 40Gbps if Thunderbolt compatible. If not, probably up to 10Gbps in USB mode	Up to 5Gbps	Up to 10Gbps (Most likely)	Up to 20Gbps (Most likely)	Up to 40Gbps

We won't even get into "Full Featured USB-C" cables versus non Full Featured USB-C cables.

20Gbps speeds in USB4. Will you hit 40Gbps? That's unknown.

As for those long active Thunderbolt 3 cables, they'll work to connect Thunderbolt 3 drives to a computer's Thunderbolt 3 port, including USB4 ports that support Thunderbolt 3. But they won't work with other USB devices.

Still confused by USB-C cables and how fast they'll run? Maybe the above chart will help a little.

WHAT WILL HAPPEN WHEN I PLUG MY USB-C CABLE INTO A NEW USB4 PORT?

Anyone's random collection of USB-C cables will work at up to their rated speeds in a USB4 port. A SuperSpeed 10Gbps-rated

cable will run at least 10Gbps, and it might possibly rise to the occasion of USB 3.2's new 20Gbps speed.

If you want to use the newest and fastest 40Gbps speed from USB4, however, you'll need new cabling. Check the labeling carefully, as USB-C cables run the gamut from fastest "full-featured" to USB 2.0-speed cheapies.

WHY COME OUT WITH USB4 RIGHT AFTER USB 3.2?!

Gearheads collectively slapped foreheads when USB4 was seemingly announced right on top of USB 3.2. The confusion lies in what's being announced. The USB 3.2 spec

was announced in July, 2017, and the spec published in September 2017. Since then, manufacturers have been working to implement the spec in actual products. The USB-IF's most recent announcement promised that the first hardware using the USB 3.2 spec, aka SuperSpeed USB 20Gbps, would go on sale this year.

USB4's news is just that hey, we're working on the spec. Even if the USB4 spec gets published this summer, we probably won't see actual hardware until at least 2021.

WILL USB4 BE AVAILABLE FOR USB-A PORTS?

No. Technically, USB4 is intended to be available only for USB-C ports. USB has

always been about respecting legacy, though, so you'll be able to plug a USB4-based peripheral into a USB-A port using a dongle. It won't operate at USB4 speeds, but it should function at that port's speed.

WILL USB4 MAKE IT EASIER TO UNDERSTAND WHAT THE USB-C PORT ON MY NEW LAPTOP DOES?

Probably not. If history provides any precedent, laptops will continue their slow evolution from physical USB-A ports to physical USB-C ports. Right now, many have a mix of ports. For their part, USB-C ports will continue a slow evolution from supporting USB 3.1 Gen 1/Gen 2 to USB



This USB-C port is clearly labeled as a SuperSpeed port which means 5Gbps is its maximum speed.

3.2 to USB4. Many laptops already mix USB port types and USB specs. It'll take years to shake out.


DOES USB4 MARK THE END OF THUNDERBOLT 3?

The future of Thunderbolt is a bit murky. USB4's incorporation of the spec suggests redundancy. However, the USB-IF and USB-PG wouldn't comment, and Intel officials we queried remained cryptic about Thunderbolt's future.

The most telling clue might be who retains control. When Intel helped create USB, PCI, SATA, PCIe, and NVMe, it gave up control of the technologies to various third-party committees. While Intel has opened up

Thunderbolt 3 to wider use, the company still maintains control of it. Intel also continues to integrate TB directly into its CPUs. This indicates to us, at least, that Intel will likely continue to develop it.

I'M STILL CONFUSED ABOUT USB. COULD YOU GIVE ME A CHART TO MAKE ME FEEL BETTER?

Sure. Although, to be honest, the multiple specifications and shifting nomenclatures could just as well make you feel worse. USB-PG chief Brad Saunders said consumers don't really care about the protocol, as long as it works. That's the dream, if not the reality. 

SPEC NAME AT LAUNCH	SPEC NAME AT LAUNCH	TODAY'S FORMAL NAME	USB TRANSFER MODE NAME	STREET NAME(S)	PORT TYPE FOR HIGHEST SPEED	INTRODUCED	THEORETICAL MAXIMUM THROUGHPUT (Mbps)	THEORETICAL MAXIMUM THROUGHPUT (MBps)
USB 1.0	USB 1.0	Basic-Speed USB	Full Speed (or Low Speed for 1.5Mbps data rate)	USB	USB Type-A, USB Type-C	1995	12Mbps	1.5Mbps
USB 2.0	USB 2.0	Hi-Speed USB	High Speed	USB 2.0	USB Type-A, USB Type-C	2000	480Mbps	60Mbps
USB 3.0	USB 3.2 Gen 1	SuperSpeed USB	SuperSpeed	USB 3.0, "USB 3.1", USB 3.1 Gen 1	USB Type-A, USB Type-C	2008	5Gbps	625Mbps
USB 3.1	USB 3.2 Gen 2	SuperSpeed USB 10Gbps	SuperSpeed+	"USB 3.1", USB 3.1 Gen 2	USB Type-A, USB Type-C	2013	10Gbps	1,250Mbps
USB 3.2	USB 3.2 Gen 2x2	SuperSpeed USB 20Gbps	SuperSpeed+ Gen 2x2	TBD	USB Type-C	2017	20Gbps	2,500Mbps
USB4	USB4 (?)	TBD	TBD	TBD	USB Type-C	2019	40Gbps	5,000Mbps

The various USB specs and terminology that have been used correctly and incorrectly could be the world's greatest card or board game.

HUAWEI IS BASICALLY FORCING FANS TO BUY THE P30 PRO BY CRIPPLING THE P30

CALL IT "ABATE AND SWITCH." BUT HEY, AT LEAST YOU GET A HEADPHONE JACK.

BY MICHAEL SIMON



LEICA
X-H16-3416-125 ASPH.

If it seems like every smartphone maker offers a choice between two models of its best phones, it's because they do. Everyone from Samsung to Apple to Google sells a standard and Plus, Max, or XL version of their flagship phones, with larger screens and various upgrades. Obviously, the larger model costs more—usually \$100 or so. In short, the more you spend, the more you get.

The difference between the S10 and S10+? A larger screen and a second front camera. The same goes for the Pixel 3 and 3XL. The iPhone XS Max and XS? Three-quarters of an inch

more screen. That's how it should be. On the one hand, you shouldn't feel like you're being punished for wanting a phone with a smaller screen, but even if the larger size brings

The Huawei P30 Pro has a spacious 6.47-inch screen, but it's only full HD, not Quad HD like the S10.



exclusive features, you shouldn't need to comb through spec sheets to decide which phone is a better fit. The differences between two models in the same series should be clear and obvious, which lets consumers make smart choices and encourages upsells.

Apparently Huawei still hasn't gotten that memo. While the P30 Pro is an excellent phone that will surely settle at or near the top of the Android leaderboard, its smaller sibling is hardly a contender. Despite sporting a similar aesthetic and naming convention, the two phones couldn't be more different. All in all, it's a confusing mess that basically makes the buying experience as unpleasant as possible—and basically forces you to choose the most expensive model.



MORE THAN SKIN-DEEP

Let's start with the display. Right off the bat, you can see that you're getting two different types: The P30 has a "flat" screen, while the P30 Pro sports curved edges. That's hardly

ideal, but I can live with it.

It gets worse as you dive into the specs, however. Like last year, the P30 Pro is the bigger phone, at 6.47 inches diagonal, versus 6.1 inches on the P30. That's an increase in size for both over last year's 5.8 inches and 6.1 inches, respectively. However, both phones are still only FHD+ resolution at

2340x1080. That means you're paying over a thousand dollars for a phone that has the same resolution as some budget phones and is nowhere near the same class as the S10 or the iPhone XS. That's not really "pro" in my book. But again, I'll let it pass.

Both phones are powered by the same Kirin 980 chip and 128GB of storage, but the P30 Pro has 2GB of extra RAM. As expected, there's also a slightly larger battery on the P30 Pro, 4200mAh versus 3650mAh on the P30.

When you charge your P30 Pro you'll find 40W SuperCharge, which can replenish the Pro's battery faster than the mere 25W charging available for the P30. And while both phones are made of glass, only the P30 Pro may be

charged wirelessly. Huawei did make a special Wireless Charging Case (go.pcworld.com/wcc) for the P30, but even if it were free (which it won't be), it's merely an admission that it should have been there in the first place.

SUPER SHOOTER VS. SUB-PAR SHOOTER

Then there's the camera. Huawei has made a big deal out of the setup on its new P30 phones, with good reason:

P30

- 40MP (Wide Angle Lens, f/1.8)
- 16MP (Ultra Wide Angle Lens, f/2.2)
- 8MP (Telephoto, f/2.4, OIS)

P30 Pro

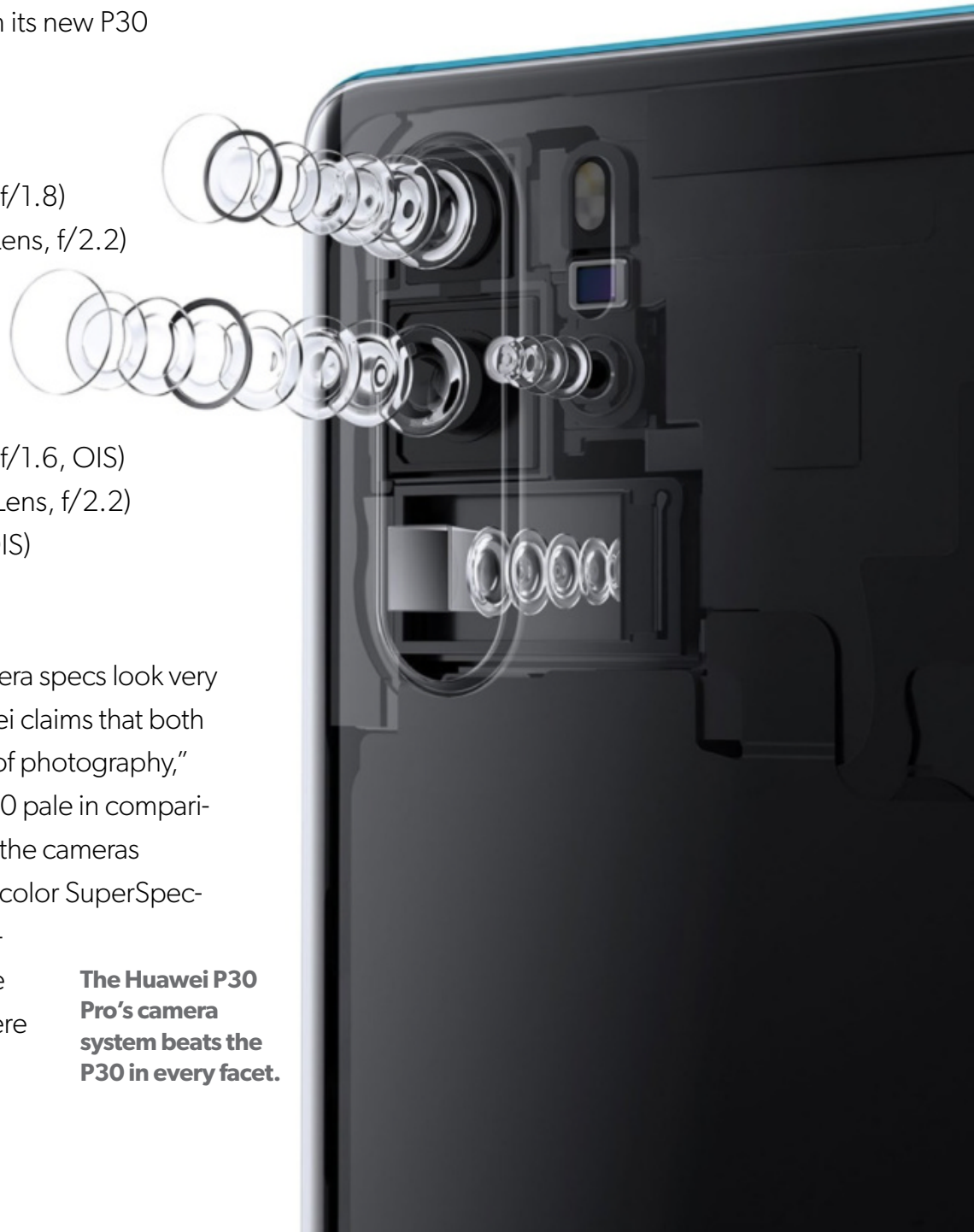
- 40MP (Wide Angle Lens, f/1.6, OIS)
- 20MP (Ultra Wide Angle Lens, f/2.2)
- 8MP (Telephoto, f/3.4, OIS)

TIME-OF-FLIGHT

While the two phones' camera specs look very similar on paper, and Huawei claims that both handsets "rewrite the rules of photography," the three cameras on the P30 pale in comparison to the P30 Pro's trio. All the cameras feature Huawei's new RYYB color SuperSpectrum sensor to bring 40 percent increased light over the P20, but that's basically where the similarities end.

For starters, the P30 Pro's sensor has a whopping ISO capability of 409,600, while the P30 tops out at 204,800. But that's hardly the only difference. The P30 Pro's main lens is also dramatically improved over the P30's, with a wider aperture and OIS, a 2.5cm macro mode, and the ability to snap long exposure shots with ease.

The telephoto lens is where the gap really



The Huawei P30 Pro's camera system beats the P30 in every facet.

widens. While they're both 8MP sensors with OIS, the P30 Pro has a periscope SuperZoom lens that offers 5X optical zoom, 10X hybrid zoom, and 50X digital zoom, compared to the P30's pedestrian 3X zoom. That's without getting into the AR and portrait benefits of the time-of-flight sensor. It's almost like Huawei went out of their way to downgrade the P30.

NOT UP TO SNUFF

But wait, there's more. The P30 Pro has standard IP68 water resistance, while the P30 gets a minimal IP53 rating. Oh, and if you want a headphone jack, Huawei has deemed that a non-Pro feature.

Add it all up, and I'm not sure either phone is worth its price tag. On the one hand, Huawei has loaded up the P30 Pro with an amazing camera and cutting-edge features, but on the other, it has a so-so display and USB-C sound. If you don't like curved screens, your only option is the P30, which is missing important features like wireless charging and water resistance, and has a really good but far from top-of-the-line camera.



Both phones have an in-display fingerprint sensor, anyway.

All that and there's \$200 separating them, which makes the decision even more confounding. While the P30 Pro is sure to be a great phone, where's the 3D face scanning tech from the Mate 20 (go.pcworld.com/ma20)? Where's the 1440p screen? As for the P30, it costs 20 percent less than the P30 Pro, but it feels like half the phone. Water resistance and wireless charging shouldn't be missing on an \$800 handset. And if you're charging a grand for a phone and basically forcing people to buy it by making the lower-cost sibling significantly worse, why release two phones at all?

It's bad enough that Huawei has been forced to stop making U.S. versions of its handsets. Now it's offering a choice that isn't really a choice at all. 🛑



END
FAMILY
FIRE

8 kids a day are accidentally killed
or injured by **FAMILY FIRE.**

FAMILY FIRE is a shooting involving an
improperly stored gun, often found in the home.

ENDFAMILYFIRE.org

Ad
Council



Two-factor authentication: How to choose the right level of security for every account

Got questions about security keys, authenticator apps, SMS, or iCloud?
We've got all the answers. **BY MICHAEL SIMON**

If you aren't already protecting your most personal accounts with two-factor or two-step authentication, you should be. An extra line of defense that's tougher than the strongest

password, 2FA is extremely important to blocking hacks and attacks on your personal data. If you don't quite understand what it is, we've broken it all down for you.

WHAT IT IS

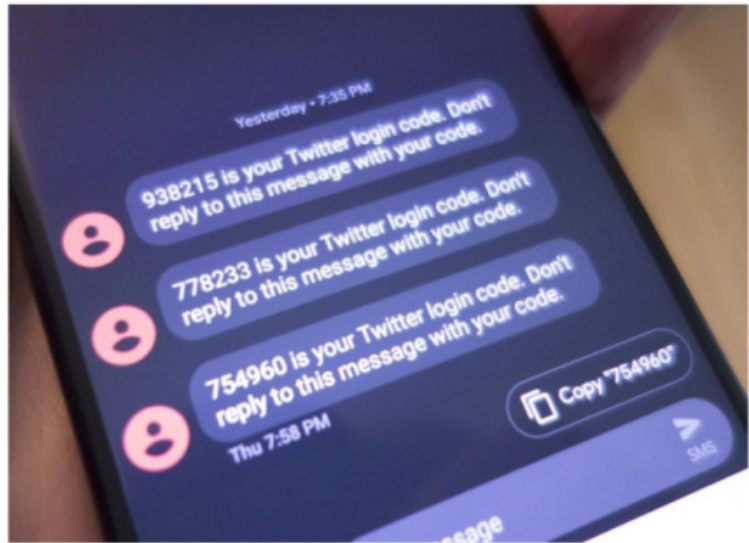
Two-factor authentication is basically a combination of two of the following factors:

1. Something you know
2. Something you have
3. Something you are

Something you know is your password, so 2FA always starts there. Rather than let you into your account once your password is entered, however, two-factor authentication requires a second set of credentials, like when the DMV wants your license and a utility bill. So that's where factors 2 and 3 come into play. Something you have is your phone or another device, while something you are is your face, irises, or fingerprint. If you can't provide authentication beyond the password alone, you won't be allowed into the service you're trying to log in to. So there are several options for the second factor: SMS, authenticator apps, Bluetooth-, USB-, and NFC-based security keys, and biometrics. So let's take a look at your options so you can decide which is best for you.

SMS

What it is: The most common "something you have" second authentication method is SMS. A service will send a text to your phone with a numerical code, which then needs to be typed into the field provided. If



When you choose SMS-based 2FA, all you need is a mobile phone number.

the codes match, your identification is verified and access is granted.

How to set it up: Nearly every two-factor authentication system uses SMS by default, so there isn't much to do beyond flipping the toggle or switch to turn on 2FA on the chosen account. Depending on the app or service, you'll find it somewhere in settings, under Security if the tab exists. Once activated you'll need to enter your password and a mobile phone number.

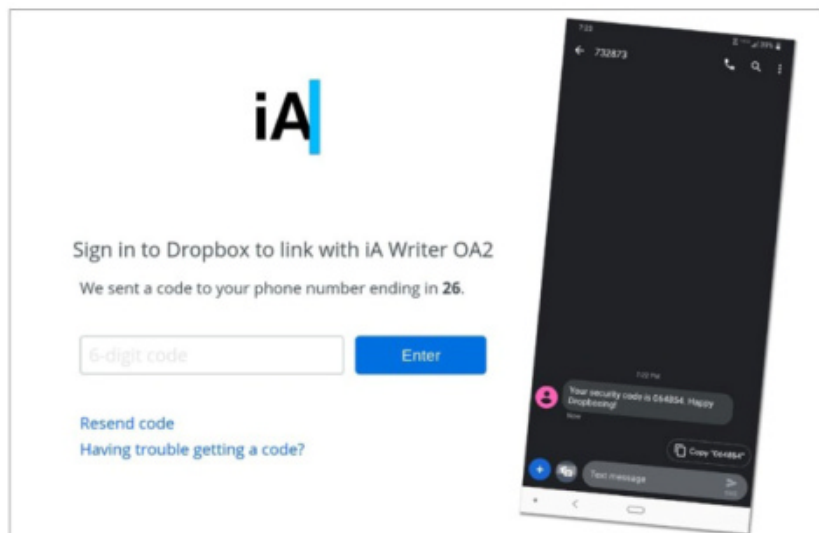
How it works: When you turn on SMS-based authentication, you'll receive a code via text that you'll need to enter after you type your password. That protects you against someone randomly logging in to your account from somewhere else, since your password alone is useless without the code. While some apps and services solely rely on SMS-based 2FA, many of

them offer numerous options, even if SMS is selected by default.

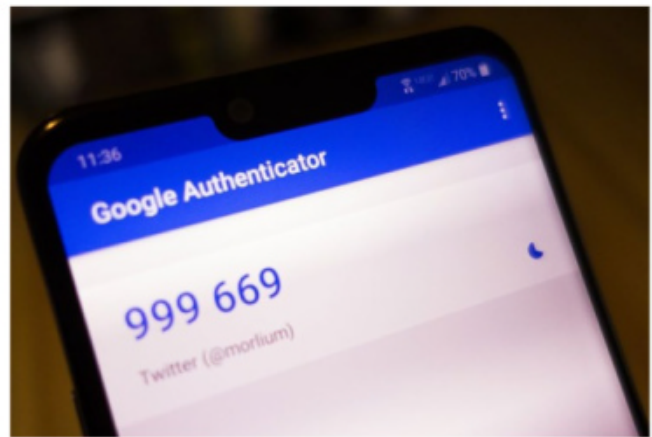
How secure it is: By definition, SMS authentication is the least secure method of two-factor authentication. Your phone can be cloned or just plain stolen, SMS messages can be intercepted, and by nature most default messaging apps aren't encrypted. So the code that's sent to you could possibly fall into someone's hands other than yours. It's unlikely to be an issue unless you're a valuable target, however.

How convenient it is: Very. You're likely to always have your phone within reach, so the second authentication is super convenient, especially if the account you're signing in to is on your phone.

Should you use it? Any two-factor authentication is better than none, but if you're serious about security, SMS won't cut it.



With SMS-based authentication, you'll get a code via text that will allow access to your account.



Authenticator apps generate random codes that aren't delivered over SMS.

AUTHENTICATOR APPS

What it is: Like SMS-based two-factor authentication, authenticator apps generate codes that need to be inputted when prompted. However, rather than sending them over unencrypted SMS, they're generated within an app, and you don't need an Internet connection to get one.

How to set it up: To get started with an

authentication app, you'll need to download one from the Play Store or the App Store. Google Authenticator works great for your Google account and anything you use it to log in to, but there are other great ones as well, including Authy, LastPass, Microsoft, and a slew of other individual companies, such as Blizzard, Sophos, and Salesforce. If an app or service supports authenticator apps, it'll supply a

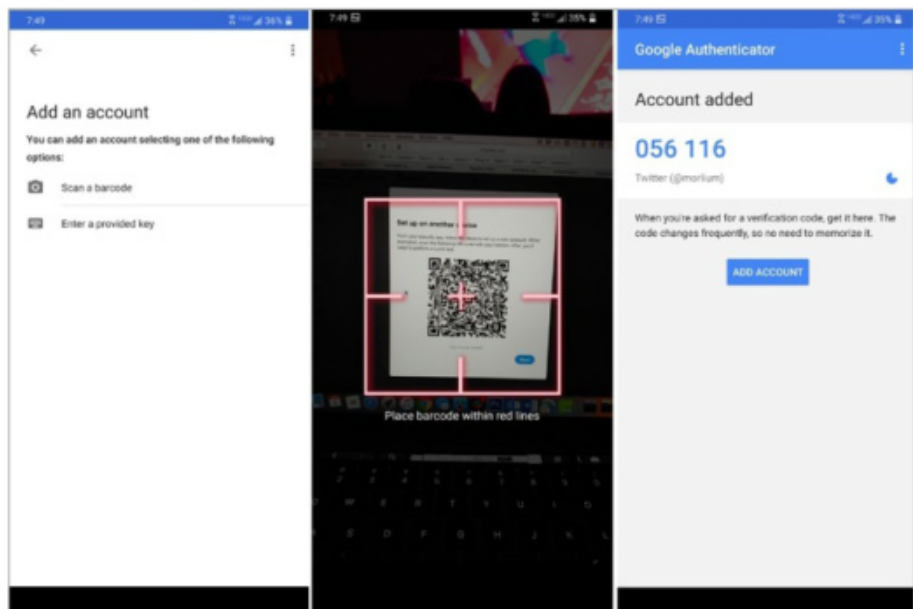
QR code that you can scan or enter on your phone.

How it works: When you open your chosen authenticator app and scan the code, a 6-figure code will appear, just like with SMS 2FA. Input that code into the app and you're good to go. After the initial setup, you'll be able to go into the app to get a code without scanning a QR code whenever you need one.

How secure it is: Unless someone has access to your phone or whatever device is running your authenticator app, it's completely secure. Since codes are randomized within the app and aren't delivered over SMS, there's no way for prying eyes to steal them. For extra security, Authy allows you to set pin and password protection, too, something Google doesn't offer on its authenticator app.

How convenient it is: While opening an app is slightly less convenient than receiving a text message, authenticator apps don't take more than few seconds to use. They're far more secure than SMS, and you can use them offline if you ever run into an issue where you need a code but have no connection.

Should you use it? An authenticator app



Authenticator apps generate randomized codes every 30 seconds and can be used offline.

strikes the sweet spot between security and convenience. While you might find some services that don't support authenticator apps, the vast majority do.

UNIVERSAL SECOND FACTOR (SECURITY KEY)

What it is: Unlike SMS- and authenticator-based 2FA, universal second factor is truly a "something you have" method of protecting your accounts. Instead of a digital code, the second factor is a hardware-based security key. You'll need to order a physical key to use it, which will connect to your phone or PC via USB, NFC, or Bluetooth.

You can buy a Titan Security Key bundle from Google for \$50 (go.pcworld.com/tsec), which includes a USB-A security key and a Bluetooth security key along with a



As their name implies, Security keys are the most secure way to lock down your account.

USB-A-to-USB-C adapter, or buy one from Yubico. An NFC-enabled key is recommended if you're going to be using it with a phone.

How to set it up: Setting up a security key is basically the same as the other methods, except you'll need a computer. You'll need to turn on two-factor authentication, and then select the "security key" option, if it's available. Most popular accounts, such as Twitter, Facebook, and Google all support security keys, so your most vulnerable accounts should be all set. However, while Chrome, Firefox, and Microsoft's Edge browser all support security keys, Apple's Safari browser does not, so you'll be prompted to switch during setup.

Once you reach the security settings page for the service you're enabling 2FA

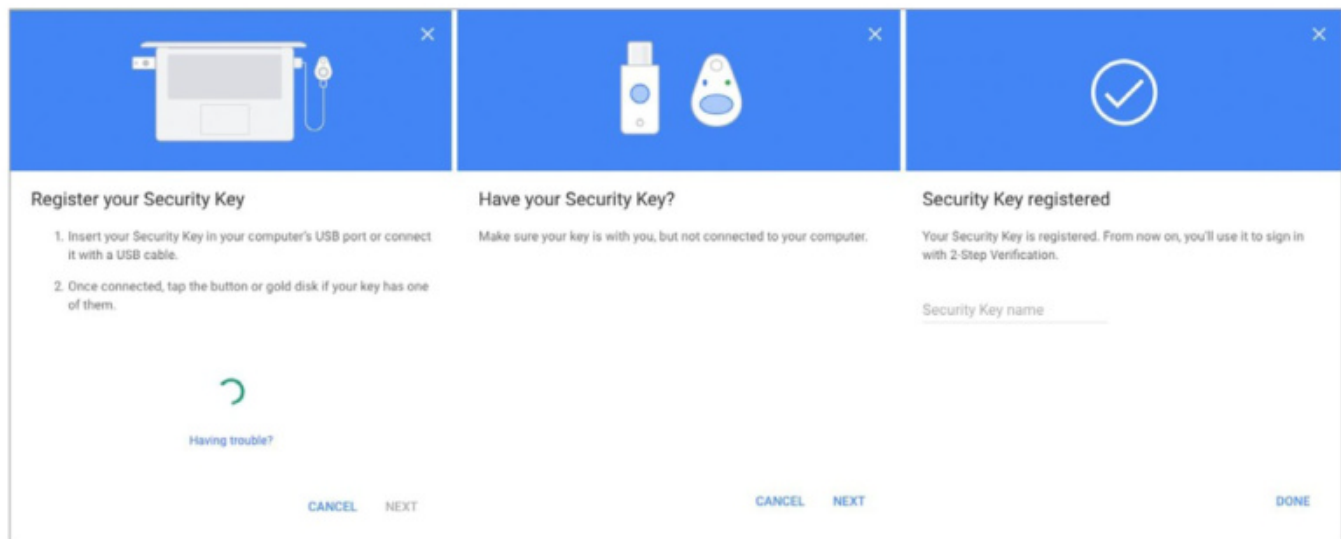
with, select Security Key, and follow the prompts. You'll be asked to insert your key (so make sure you have a USB-C adapter on hand if you have a MacBook) and press the button on it. That will initiate the connection with your computer, pair your key, and in a few seconds your account will be ready to go.

How it works: When an account requests 2FA

verification, you'll need to plug your security key into your phone or PC's USB-C port or (if supported) tap it to the back of your NFC-enabled phone. Then it's only a matter of pressing the button on the key to establish the connection and you're in.

How secure it is: Extremely. Since all of the login authentication is stored on a physical key that is either on your person or stored somewhere safe, the odds of someone accessing your account are extremely low. To do so, they would need to steal your password and the key to access your account, which is very unlikely.

How convenient it is: Not very. When you log in to one of your accounts on a new device, you'll need to type your password and then authenticate it via the hardware key, either by inserting it into your PC's USB



Setting up your security key with your Google account is a multi-step process.

port or pressing it against the back of an NFC-enabled phone. Neither method takes more than a few seconds, though, provided you have your security key within reach.

GOOGLE ADVANCED PROTECTION PROGRAM

What it is: If you want to completely lock down your most important data, Google offers the Advanced Protection Program for your Google account, which disables everything except security key–based 2FA. It also limits access your emails and Drive files to Google apps and select third-party apps, and shuts down web access to browsers other than Chrome and Firefox.

How to set it up: You'll need to make a serious commitment. To enroll in Google Advanced Protection, you'll need to purchase two Security Keys: one as your main key and one as your backup key.

Google sells its own Titan Security Key bundle, but you can also buy a set from Yubico or Feitian.

Once you get your keys, you'll need to register them with your Google account and then agree to turn off all other forms of authentication. But here's the rub: To ensure that every one of your devices is properly protected, Google will log you out of every account on every device you own so you can log in again using Advanced Protection.

How it works: Advanced Protection works just like a security key except you won't be able to choose a different method if you forgot or lost your security key.

How secure it is: Google Advanced Protection is basically impenetrable. By relying solely on security keys, it makes sure that no one will be able to access your account without both your password and physical key, which is extremely unlikely.

How convenient it is: By nature, Google Advanced Protection is supposed to make it difficult for hackers to access your Google account and anything associated with it, so naturally it's not so easy for the user either. Since there's no fallback authentication method, you'll need to remember your key whenever you leave the house. And when you run into a roadblock—like the Safari browser on a Mac—you're pretty much out of luck. But if you want your account to have the best possible protection, accept no substitute.

BIOMETRICS

What it is: A password-free world where all apps and services are authenticated by a fingerprint or facial scan.

How to set it up: You can see biometrics at work when you opt to use the fingerprint scanner on your phone or Face ID on the iPhone XS, but at the moment, biometric



Nearly every smartphone made today has some form of secure biometrics built into it.

security is little more than a replacement for your password after you login in and verify via another 2FA method.

How it works: Like the way you use your fingerprint or face to unlock your smartphone, biometric 2FA uses your body's unique characteristics as your password. So your Google account would know it was you based on your scan when you set up your account, and it would automatically allow access when it recognized you.

How secure it is: Since it's extremely difficult to clone your fingerprint or face, biometric authentication is the closest thing to a digital vault.

How convenient it is: You can't go anywhere without your fingerprint or your face, so it doesn't get more convenient than that.

iCLOUD

What it is: Apple has its own method of two-factor authentication for your iCloud and iTunes accounts that involves setting up trusted Apple devices (iPhone, iPad, or Mac—Apple Watch isn't supported) that can receive verification codes. You can also set up trusted numbers to receive SMS codes or get verification codes via an authenticator app built into the Settings app.

How to set it up: As long as you're logged in to your iCloud account, you can turn on two-factor authentication



Apple sends a code to one of your trusted devices when it needs authentication to access an account.

from almost anywhere. Just go into Settings on your iOS device or System Preferences on your Mac, PC, or Android phone, then Security, and turn on Two-Factor Authentication. From there, you can follow the prompts to set up your trusted phone number and devices.

How it works: When you need to access an account protected by 2FA, Apple will send a code to one of your trusted devices. If you don't have a second Apple device, Apple will send you a code via SMS or you can get one from the Settings app on your iPhone or System preferences on your Mac.

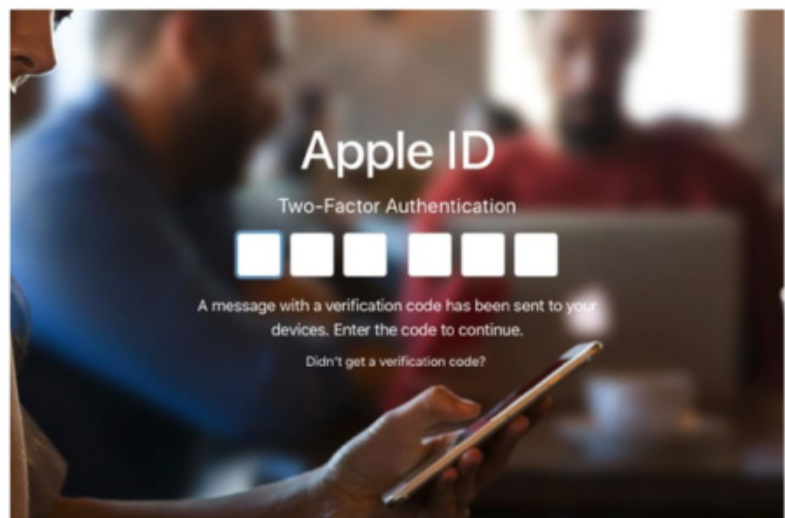
How secure it is: It depends on how many Apple devices you own. If you own more than one Apple device, it's very secure. Apple will send a code to one of your other

devices whenever you or someone else tries to log in to your account or one of Apple's services on a new device. It even tells you the location of the request, so if you don't recognize it you can instantly reject it, before the code even appears.

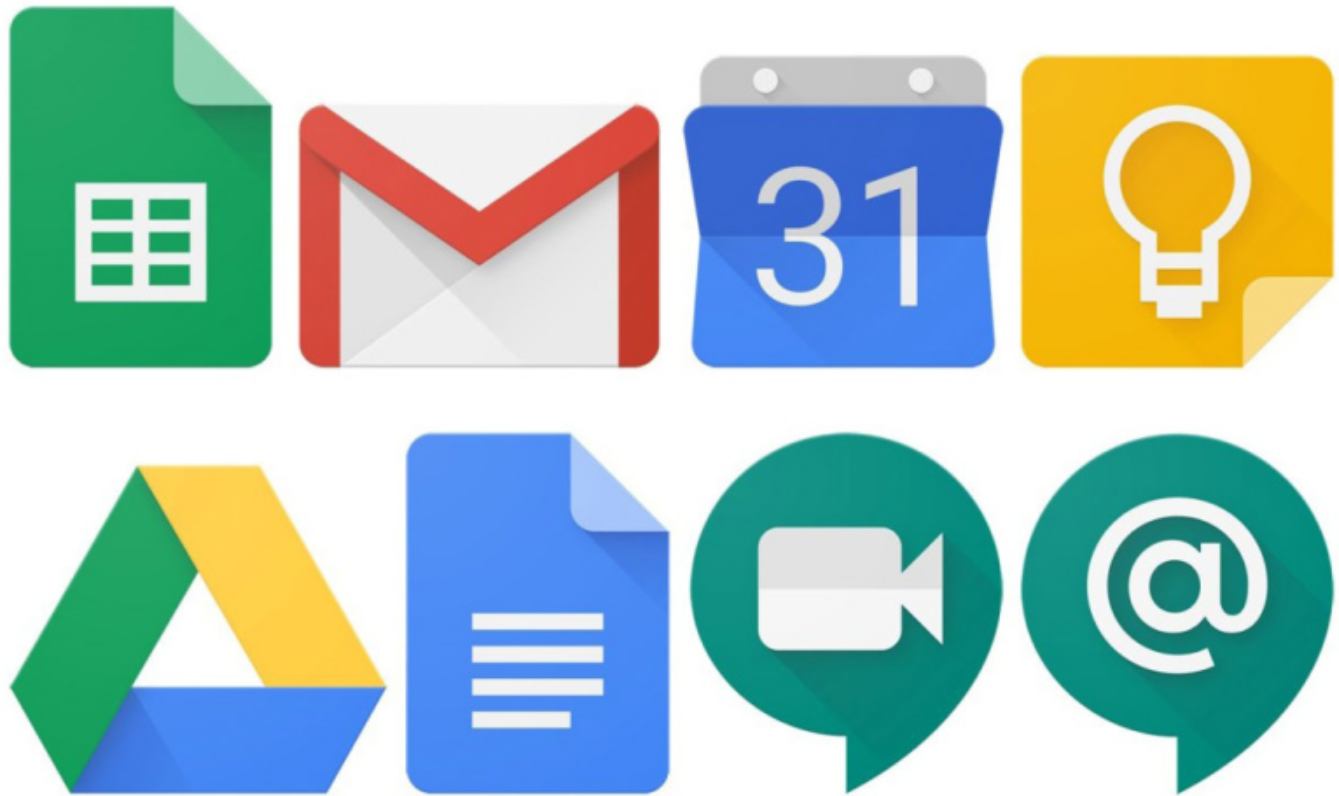
If you only have one device, you'll have to use SMS or Apple's built-in authenticator, neither of which is all that secure, especially since it's likely to both be done using the same device. Also, Apple has a weird snafu that sends the 2FA access code to the same

device when you manage your account using a browser, which also defeats the purpose of 2FA.

How convenient it is: If you're using an iPhone and have an iPad or Mac nearby, the process takes seconds, but if you don't have an Apple device within reach or are away from your keyboard, it can be tedious. 🛑



When Apple needs a code to log in to an account, it sends it to one of your trusted devices.



5 Google G Suite changes that will improve your life

For workers, connections between apps, services, data, and employees are now the name of the game. **BY MARK HACHMAN**

Designing an effective productivity suite is increasingly about connections: between services, between data sources, between employees, and between apps. At Google Next, Google debuted a number of upgrades to its G Suite of business apps, which have competed against Microsoft Office and its ecosystem for years.

According to Google, more than 5 million businesses have signed up for G

Suite. (Microsoft has said previously that it has more than 60 million commercial customers for Office 365.) But like Microsoft's relationship with Slack (go.pcworld.com/slak), Microsoft isn't necessarily averse to partnering with potential adversaries. And that means if you're using Slack, or G Suite, that doesn't mean you won't be able to directly interact with a Word document.

If you're a Google G Suite user, here are

five ways that G Suite will change for you:

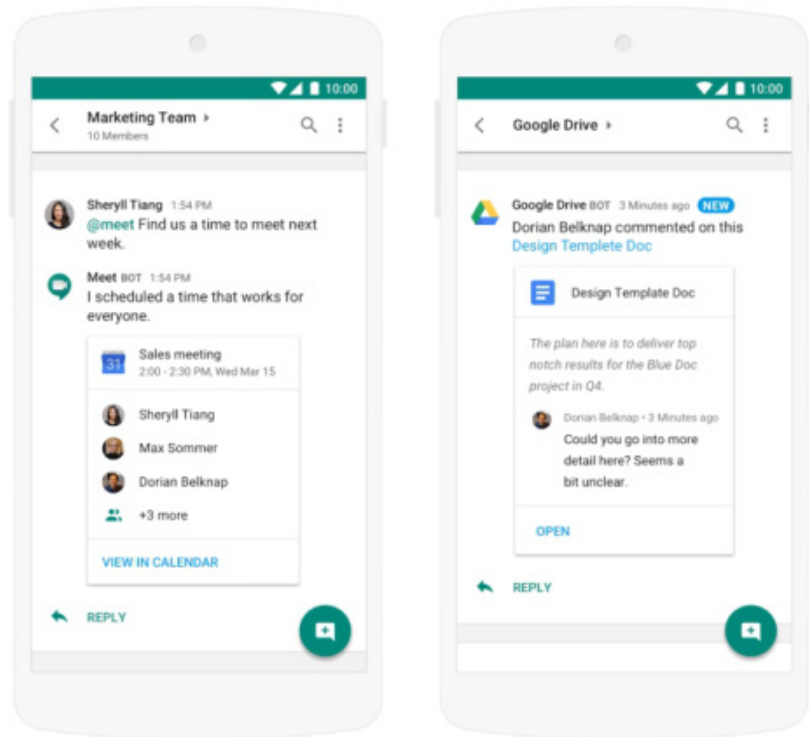
1. OFFICE EDITING IN DOCS, SHEETS, AND SLIDES

While Office and G Suite workers can already interact with common documents, it's always been a bit of a ballet between what files can be opened by which suite, and which require conversion. What Google said is that you'll be able to work on Office files straight from within G Suite without any file conversion.

According to Google, this will allow you to take advantage of Google's AI-powered grammar suggestions. (Note that Office, of course, offers its own spelling and grammar suggestions, too.)

2. HANGOUTS ADDS TRANSCRIPTIONS, STREAMING, AND GMAIL INTEGRATION

There are two versions of Hangouts for businesses: Hangouts Meet (the videoconferencing portion) and Hangouts Chat (which focuses on chat). It's natural that the text-based Chat option would be more closely integrated into other text-based Google apps, and it's happening—you'll start to see Hangouts Chat more closely tied into Gmail, with chats taking place in the



Hangouts Chat.

same window that you'll exchange email with your coworkers.

Likewise, Google is starting to respond to Microsoft, whose Skype videoconferencing apps are becoming more defined by their ability to transcribe and translate content than just allowing more than one employee to talk to one another. Hangouts Meet now has automatic live captioning, though just in English. In addition, Meet now has the ability to livestream to up to 100,000 viewers—though YouTube has tended to handle this quite well already.

3. VOICE IS NOW PART OF G SUITE

Continuing the trend of connecting

employees, Google announced (finally!) that Google Voice is now part of G Suite, in “select markets.” Voice gives employees, and personal users, their own phone number. Google has also used the service to show off its AI capabilities in terms of transcription and blocking voice calls, and it’s now finally available to business users.

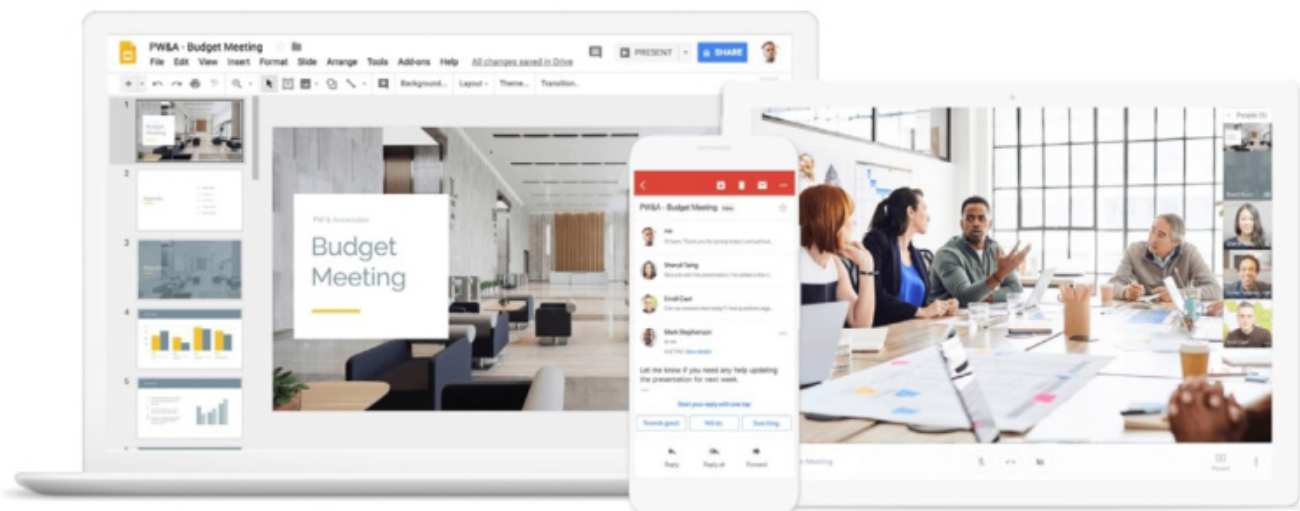
4. GOOGLE ASSISTANT BREAKS INTO G SUITE

Speaking of AI, it’s been a long time coming for the Google Assistant to break out of the smartphone and into other areas within Google’s ecosystem. (Cortana has been integrated into Edge as well as other Office apps, by contrast.) Unfortunately, Google Assistant isn’t penetrating any further than the Google Calendar app, and in beta, to boot. But at least you’ll be able to ask Google when your next meeting is. It’s a start.

5. ADD-ONS ARE NOW PART OF G SUITE, TOO

We have to go all the way back to 2005 to find the first instance of Office Add-ins (go.pcworld.com/addd), which bolts on additional functionality to Microsoft Office apps like Word or PowerPoint. Now, add-ins are coming to the right-hand rail of Google’s G Suite apps, too. Those apps will include Copper, Workfront, Box, and others. Unfortunately, they’ll debut in beta, which you’ll have to sign up for (go.pcworld.com/gsui) and will debut in the coming months.

Google has listed several new additions as part of its blog post (go.pcworld.com/nwad) announcing the new changes. G Suite has remained in a somewhat bare-bones state for some time now—and that’s not necessarily a bad thing for fans of simple efficiency. Still, several of these changes now seem obvious in retrospect, and long overdue. 🏠





15 instant improvements to your Samsung Galaxy S10 or Note9

Got a new Samsung phone? Don't miss these tips. **BY JARED NEWMAN**

Samsung's Galaxy S10 (go.pcworld.com/s10p) and Note9 (go.pcworld.com/n9e) are sort of like the Las Vegas of smartphones. Compared to the simple and understated approach of, say, an iPhone or Google Pixel 3 (go.pcworld.com/pix3), Samsung bombards you with settings to tweak and features to try. Much like a walk down the strip at night, this approach can

feel overwhelming.

You can tone down the gaudiest features and tune others to suit your needs better. Here are 15 instant improvements you can make to a new Samsung phone:

1. REMAP THE BIXBY BUTTON

The mandatory inclusion of the Bixby voice assistant is arguably the worst feature of modern Samsung phones. Fortunately, you

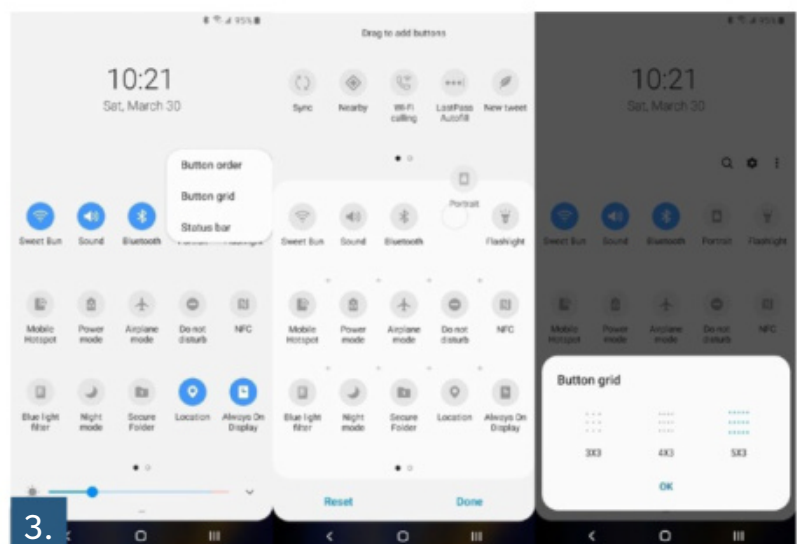
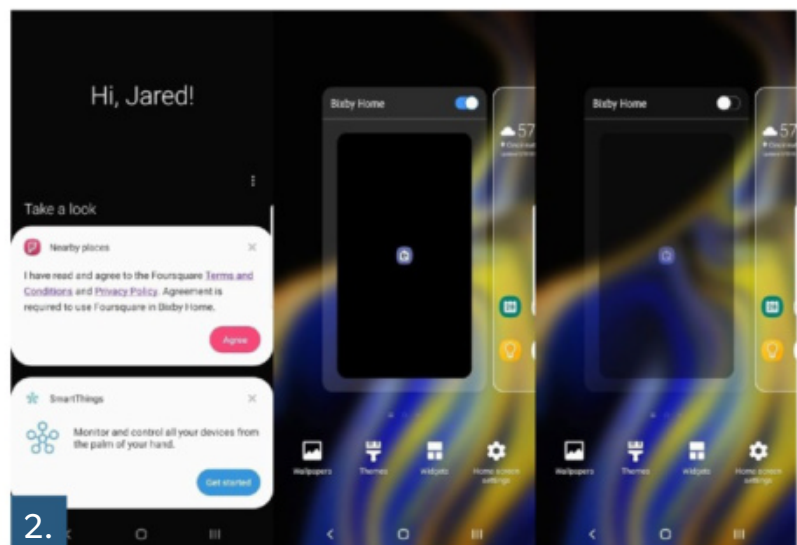
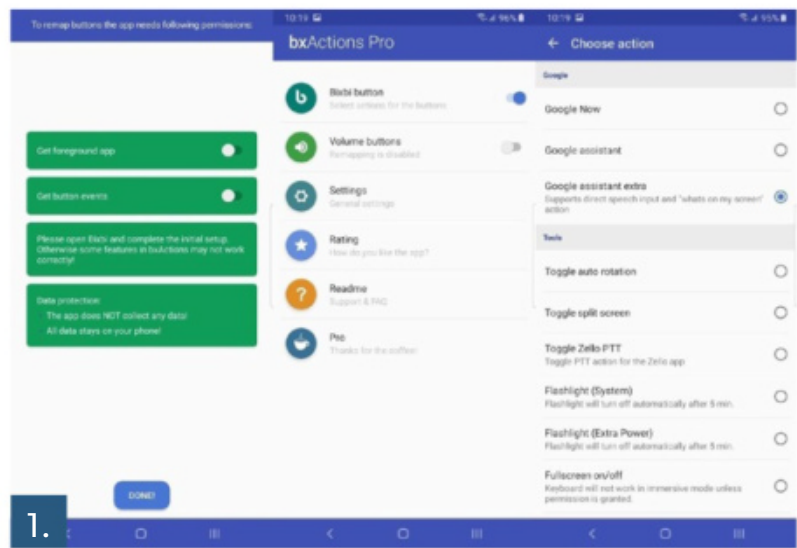
can remap the button with a third-party app called bxActions (go.pcworld.com/bxac). Before you install the app, make sure to launch Bixby once, then go through the standard setup process. Next, launch bxActions, walk through the setup process, then select Bixbi [sic] Button to choose an alternative action. You can even use this to launch Google Assistant instead of Bixby.

2. HIDE THE BIXBY HOME SCREEN

By default, swiping right on your home screen will bring up an information feed from Bixby, including weather, news, sports scores, calendar updates, and more. You can disable this by long-pressing anywhere on the home screen, swiping right, and turning off the Bixby Home toggle.

3. REARRANGE YOUR QUICK SETTINGS

Like other Android phones, Samsung lets you easily toggle common settings such as Wi-Fi and Bluetooth by swiping down from the top of the screen—one swipe for your favorite six toggles, and a second swipe for a longer list of



options. To rearrange the order of these settings—or remove them entirely—swipe down a second time, hit the menu button that looks like three dots, then select Button order. Press and hold any icon to reposition it, and don't forget you can swipe left to see additional icons.

4. ADD A SCREEN BRIGHTNESS SHORTCUT

By default, Samsung's Galaxy Note9 and S10 require two swipes from the top of the screen to access the brightness slider. Make it easier to reach by pressing the down arrow next to the slider, then toggling Show control on top. Now, you only have to swipe down once to see the brightness toggle.

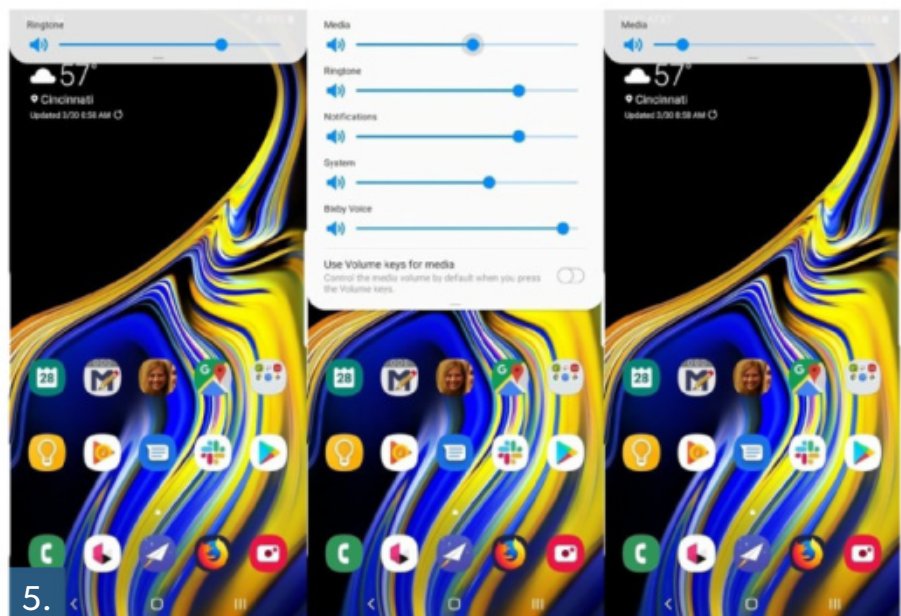
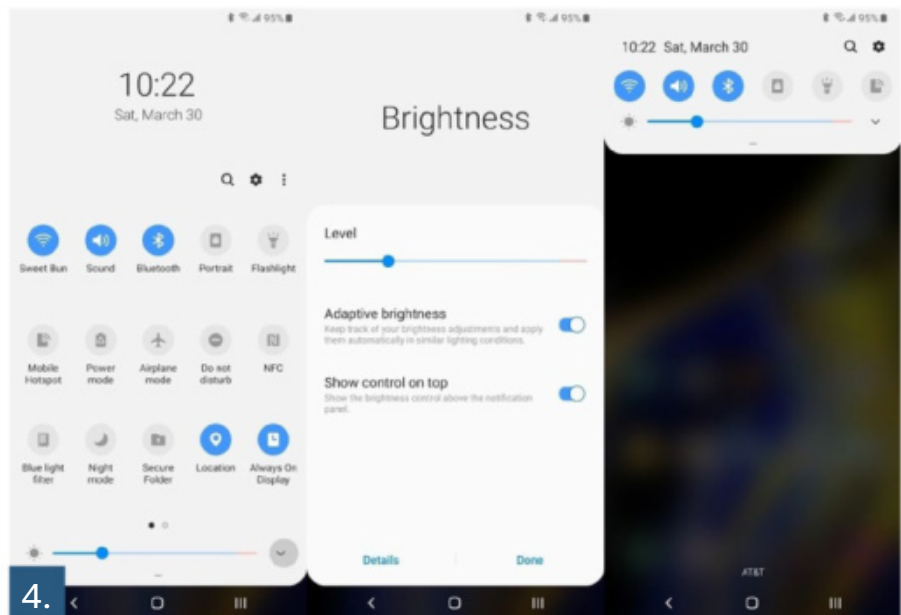
5. ASSIGN VOLUME KEYS TO MEDIA PLAYBACK

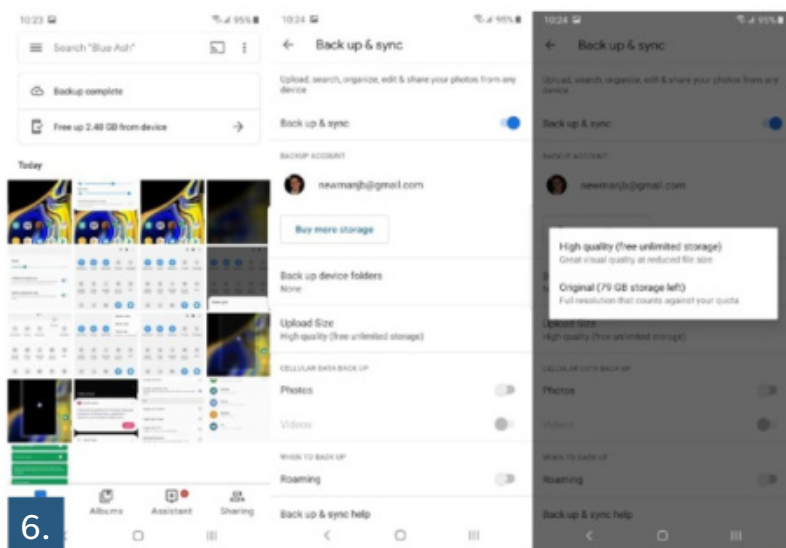
In Android Pie, Google changed the standard behavior of volume keys to control media volume (such as music and videos) instead of the ringer. Samsung phones' volume keys still

control the ringer by default, but you can change this by pressing either volume button, swiping down on the volume control, and toggling Use Volume Keys For Media.

6. SET UP PHOTO BACKUPS

Samsung's setup process doesn't include a way to back up your photos, so you'll have to

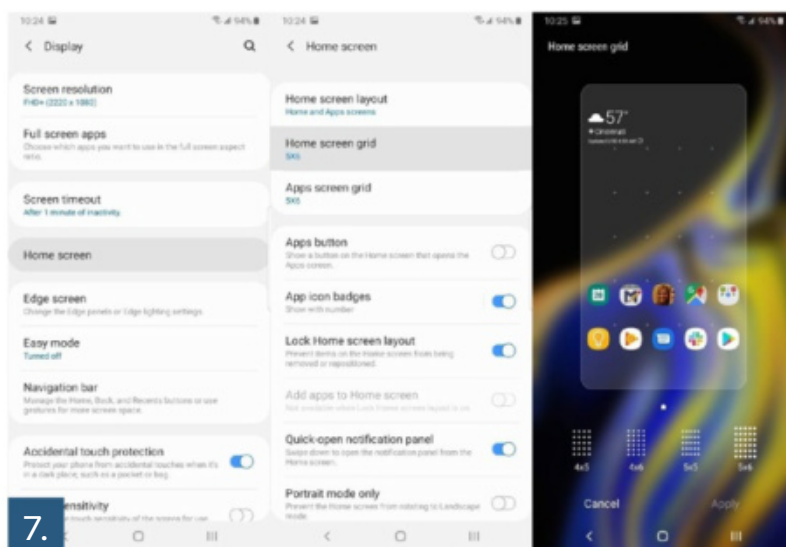




add a backup system once your phone is up and running. The Google Photos app (go.pcworld.com/gpho) will automatically back up unlimited photos for free (albeit at reduced resolution unless you use Google Drive storage). You can also use other cloud storage services such as Dropbox and OneDrive.

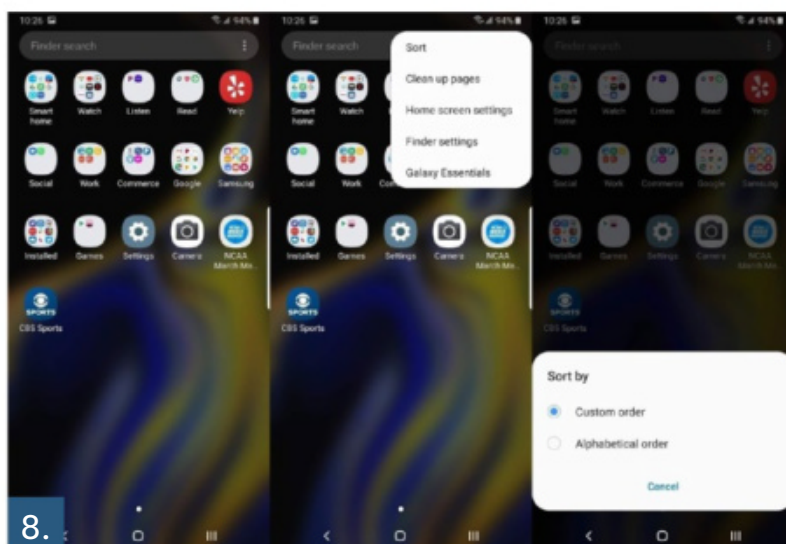
7. FIT MORE APPS ON THE HOME SCREEN

Samsung's smartphone displays have gotten so large, it's a shame the home screen's icons are so spread out. Stack more icons vertically by heading to Settings > Display > Home Screen, then tapping Home screen grid.



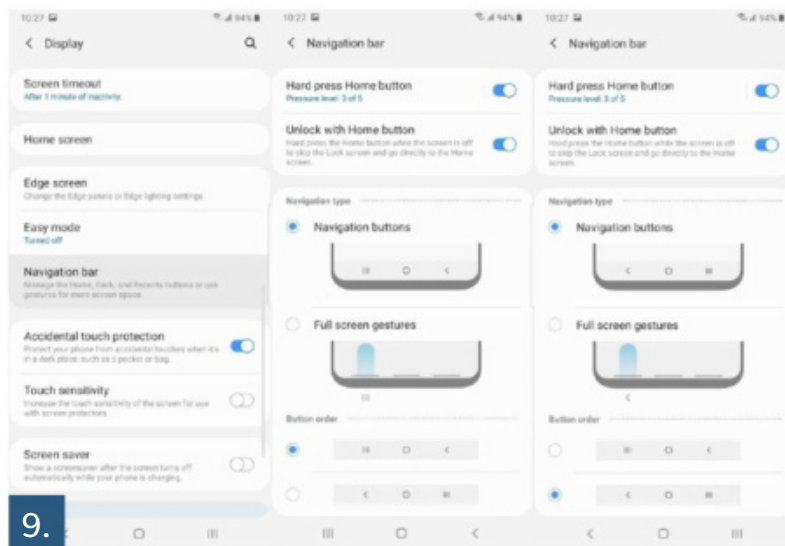
8. CUSTOMIZE THE APP TRAY

Samsung offers a couple of ways to sort your master apps list, which is accessible by swiping up from the home screen. By default, you can arrange the apps in any order by long-pressing, then dragging them around. (You can even move them into folders, which is great.) If you'd rather sort the apps alphabetically, tap the three dots to the right of the search bar, select Sort, then choose Alphabetical order.



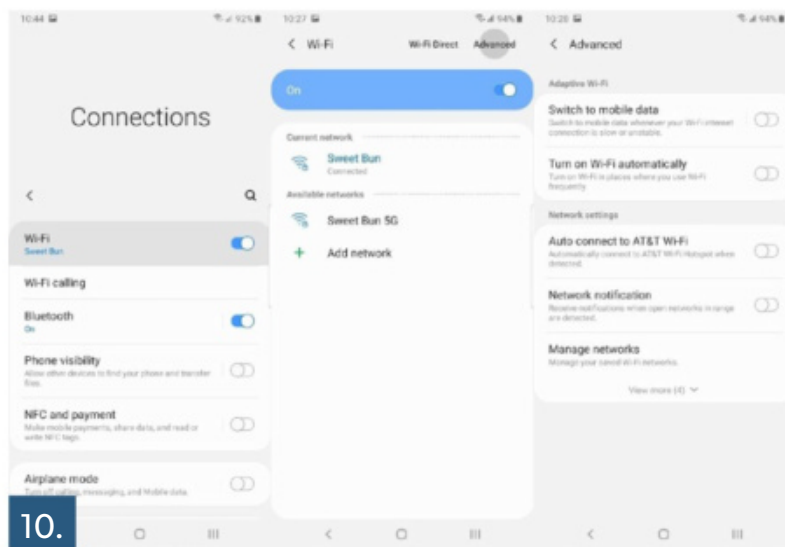
9. FLIP THE BACK AND RECENT BUTTONS

Unlike many other Android phones, Samsung's have the back button on the right and the recently-used apps button on the left. Flip these around by heading to Settings > Display > Navigation Bar, then choose the arrangement you want under Button Order.



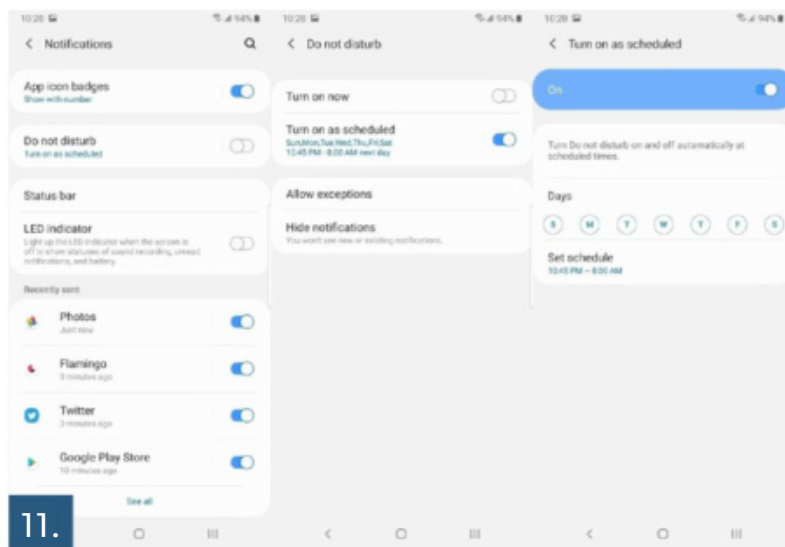
10. TURN OFF OPEN WI-FI NETWORK NAGS

For some reason, Android phones like to notify you constantly when there's an open Wi-Fi network in range, regardless of the potential security risks (go.pcworld.com/risk) and unreliability of connecting to random hotspots. Turn off these nags by heading to Settings > Connections, then selecting Wi-Fi. (Make sure to press the text, not the toggle on the right.) On the next screen, select Advanced, then turn off the toggle for Network notification. If your carrier has a setting for auto-connecting to its own hotspots, I suggest turning that off as well.



11. SET UP DO NOT DISTURB

Don't want to be woken up in the night by social media mentions and



non-urgent texts? Create a Do Not Disturb schedule by heading to Settings > Notifications > Do Not Disturb. Tap on the Turn On As Scheduled text, and set up the times and days of the week on which you don't want to be bothered. Select Allow Exceptions to choose which alerts you'd like to let through. (Enabling repeat calls and calls from favorite

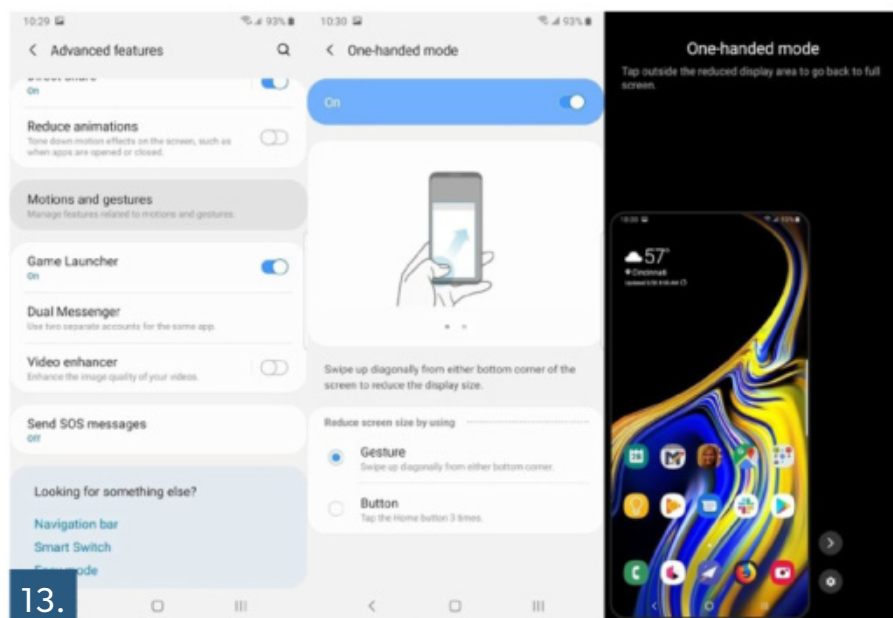
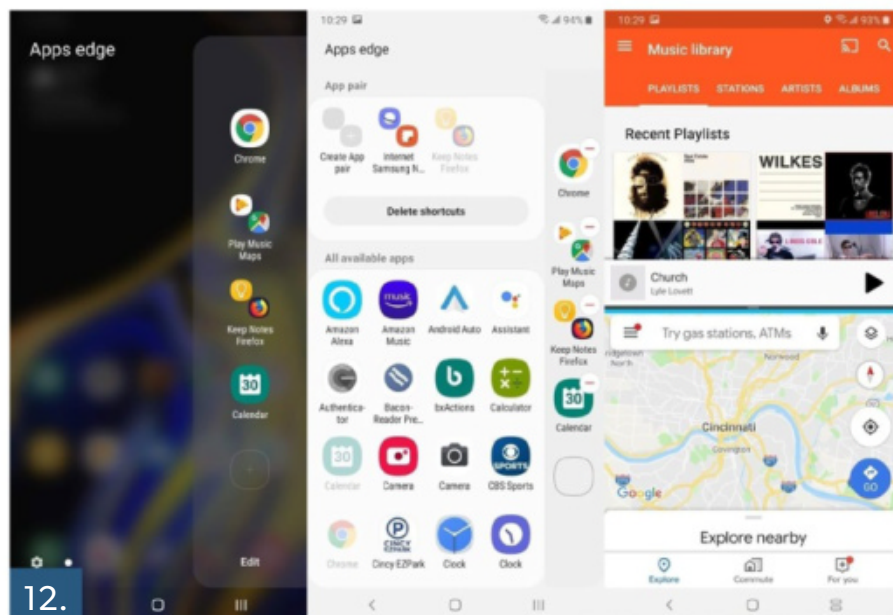
contacts is a good idea for emergencies.)

12. SET UP SOME APP PAIRS

Arguably the neatest feature on Samsung phones, App Pairs let you quickly launch two apps side by side. It's great for listening to music while navigating in Google Maps, taking notes while browsing the web, or

checking Twitter while watching TV. To set these up, swipe left on the small white strip on the left side of the screen, hit Edit and select Create App Pair on the next screen.

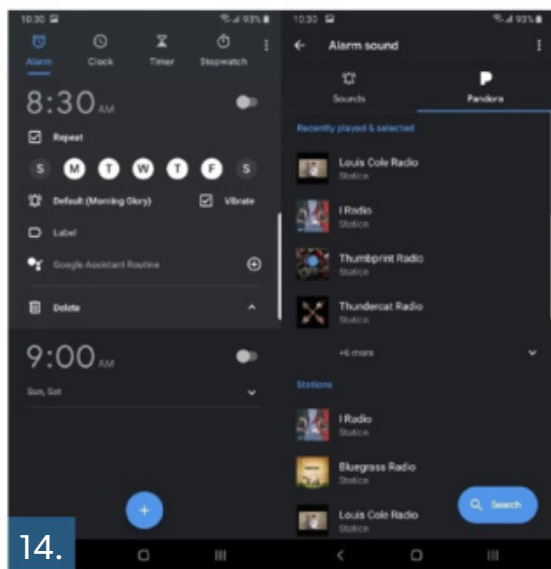
To put this side panel to even greater use, hit the gear icon in the bottom-left corner of the screen while viewing the panel. From here, you can add shortcuts to your contacts list, reminders, clipboard, and more.



13. ENABLE ONE-HANDED MODE

Although Samsung's "One UI" (go.pcworld.com/sm1u) is supposed to make one-handed operation easier by putting common buttons on the lower portion of the screen, many apps continue to

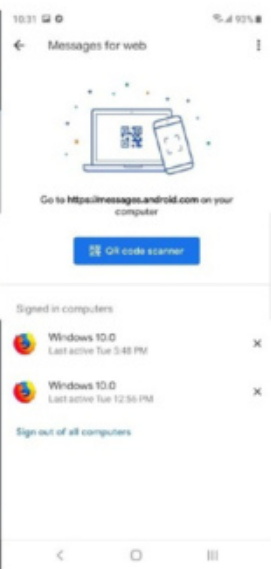
make things hard to reach. Enabling Samsung's one-handed mode can help out in a pinch by shrinking the usable area of the screen. Head to Settings > Advanced Features > Motions And Gestures, then toggle One-Handed Mode. Turn it on by swiping diagonally out from the bottom corner of the screen, and turn it back off by tapping anywhere outside the one-handed area.




14. USE GOOGLE'S MESSAGE AND CLOCK APPS

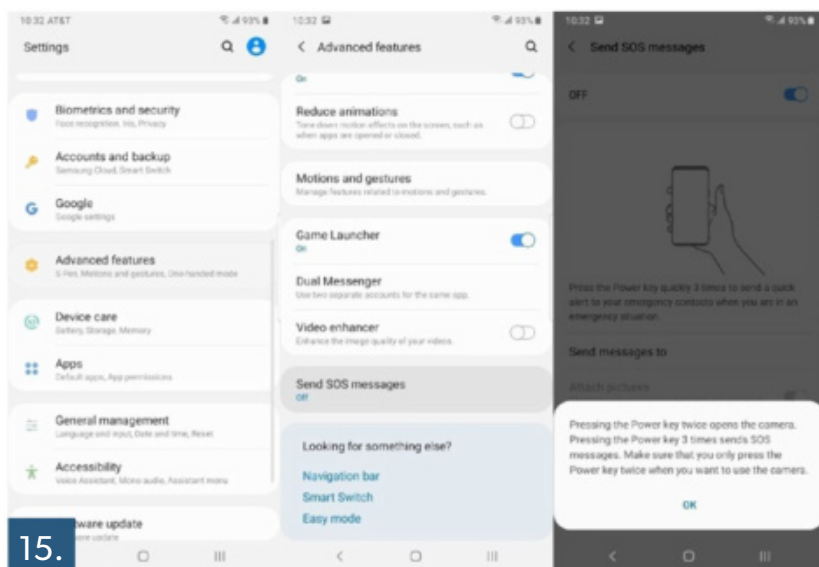
Samsung's built-in text and clock apps are fine as is, but Google's versions offer some extra features that could make them worth using instead. Google Messages (go.pcworld.com/msgs), for instance, lets you read and send texts from your computer by visiting messages.android.com (go.pcworld.com/msan), while

Google Clock (go.pcworld.com/clok) lets you wake up to smart home routines from Google Assistant, or to music from Spotify, Pandora, or YouTube Music.



15. SET UP SOS

To protect yourself in emergencies, you can set up an SOS feature that sends a message to emergency contacts of your choosing when you quickly press the power button three times. You can also optionally have the phone send an audio recording and photos from the front and rear cameras. Enable this by heading to Settings > Advanced Features > Send SOS Messages. You'll have to add at least one emergency contact to complete the setup. 



How to create, filter, and format tables in Excel

Tables give you options plain old spreadsheets can't. **BY JD SARTAIN**



What's the difference between a table and a range of columns and rows on an Excel spreadsheet? How do I create and populate tables? And, once a table is created, how do I custom filter, format, and design those tables so they look professional in a report? We'll show you how it's done.

WHAT'S THE DIFFERENCE BETWEEN A TABLE AND A RANGE IN AN EXCEL SPREADSHEET?

There's not much difference regarding the data. Both use columns (the database fields) and rows (the database records), and both can be sorted, filtered, calculated, custom formatted, and printed.

Tables, however, have many additional benefits that regular spreadsheets lack. The biggest plus is the option to use data from multiple tables to create queries and reports. For example, say that TABLE ONE (Corp) has the company name, address, city, state, zip code, and phone number; while TABLE TWO (Products) has the company name, product number, product name, price, inventory, discounts, etc.; and TABLE THREE (Orders) has the product number, number of products ordered, price, extended price, sales, tax, and totals.

TABLE ONE (Corp) is “connected” to TABLE TWO (Products) by the unique field called “Company.” TABLE TWO is connected to TABLE THREE (Orders) by the unique field called “Product Number.” These are called “relationships” and save you from continually duplicating fields/data on three different spreadsheets (or tables). Because each company can have multiple products, and each product can have multiple orders, you really need three separate tables to accurately manage this type of data. We’ve provided this sample spreadsheet so you can follow along (go.pcworld.com/sprd).

For deeper dives, check out my earlier articles on creating relational tables (go.pcworld.com/rlat) and creating relational databases (go.pcworld.com/rldb).

Resort	City	State	Size/Acres of Skiable Terrain	Vertical Feet Vertical Drop	Base Elevation Feet	Average Annual Snowfall (Inches)	Average Winter Temperature in Degrees Fahrenheit	# of Chairlifts	# of Gondolas	# of Trans
Squaw Valley	Olympic Valley	California	3600	2850	6200	450	38	27	0	2
Heavenly Ski Resort	South Lake Tahoe	California	4800	3500	6255	360	38	26	2	0
Homewood Mountain Resort	Homewood	California	1280	3650	6230	450	38	8	0	0
Alpine Meadows Ski Resort	Olympic Valley	California	3400	3800	6885	450	37	13	0	0
Vail Ski Resort	Vail	Colorado	3400	3800	6885	184	37	28	2	0
Steamboat Springs Ski Resort	Steamboat Springs	Colorado	336	336	936	336	27	15	2	0
Aspen Snowmass	Aspen	Colorado	300	35	15	2	0			
Telluride Ski Resort	Telluride	Colorado	309	33	13	1	0			
Taos Ski Valley	Taos	New Mexico	300	36	15	0	0			
Park City Mountain Resort	Park City	Utah	365	35	41	4	0			
Deer Valley Resort	Park City	Utah	2000	3000	6570	360	36	21	0	0
Après Vous & Rendezvous Mountain	Teton Village at Jackson Hole	Wyoming	2500	4139	6311	459	21	12	2	1
Grand Targhee Ski Resort	Targhee	Wyoming	3000	2270	7851	500	31	5	0	0

Create an Excel table in two seconds.

CREATE AN EXCEL TABLE

1. First, enter the field names in the columns across the top, and then enter some records/data in the rows under each column. You could also open a workbook that’s already created and populated with data, or download the spreadsheet table we provided above.

2. Place your cursor anywhere inside the range you want to convert to a table.

3. Select INSERT > Table.

4. The Create Table dialog opens with the table range pre-selected. If this is wrong, enter (or point) to the correct range; however, if correct, check the box that says My Table Has Headers, then click OK.

5. Excel converts the range into a beautiful color table with dark blue column headers and alternating shades of blue on every other row for an easy “at a glance” view of your data.

Resort	City	State	Size/Acres of Skiable Terrain	Vertical Feet Vertical Drop	Base Elevation Feet	Average Annual Snowfall (Inches)	Average Winter Temperature in Degrees Fahrenheit	# of Chairlifts	# of Gondolas	# of Trams
Park City Mountain Resort	Park City	Utah	7300	3200	8900	500	31	5	0	0
Après Vous & Rendezvous Mountain	Teton Village at Jackson Hole	Wyoming	2500	4139	8311	409	21	12	2	1
Deer Valley Resort	Park City	Utah	2000	3000	6570	300	36	21	0	0
Vail Ski Resort	Vail	Colorado	5289	3450	8120	104	37	28	2	0
Grand Targhee Ski Resort	Targhee	Wyoming	4800	3500	6255	300	36	26	2	0
Steamboat Springs Ski Resort	Steamboat Springs	Colorado	3000	3668	8900	336	27	13	2	0
Aspen Snowmass	Aspen	Colorado	675	3267	7945	300	35	15	2	0
Telluride Ski Resort	Telluride	Colorado	2000	4425	8750	509	33	13	1	0
Squaw Valley	Tacoma	New Mexico	1294	3274	5200	300	36	15	0	0
Alpine Meadows	Olympic Valley	California	2400	1802	6835	400	37	13	0	0
Homewood	Homewood	California	1260	1650	6230	400	38	8	0	0
Park City Mountain Resort	Park City	Utah	7300	3200	8900	305	35	41	4	0
Heavenly Ski Resort	South Lake Tahoe	California	4800	3500	6255	300	36	26	2	0
Steamboat Springs Ski Resort	Steamboat Springs	Colorado	3000	3668	8900	336	27	13	2	0
Telluride Ski Resort	Telluride	Colorado	2000	4425	8750	509	33	13	1	0
Deer Valley Resort	Park City	Utah	2000	3000	6570	300	36	21	0	0
Aspen Snowmass	Aspen	Colorado	675	3267	7945	300	35	15	2	0
Taco Ski Valley	Taco	New Mexico	1294	3274	5200	300	36	15	0	0
Vail Ski Resort	Vail	Colorado	5289	3450	8120	104	37	28	2	0

Use the Filter to sort + query the table for specific information.

In addition, notice that the filter feature is automatically applied, so sorting by a specific field is accomplished by a few clicks of the mouse.

6. For example, if you want to see which ski resorts get the most snow, click the down arrow beside the column/field called Average Annual Snowfall (inches). Select Sort Largest To Smallest, and it's done. You don't even have to click OK.

Notice that Grand Targhee Ski Resort in Targhee, Wyoming, tops the list with an annual snowfall of 500 inches. (And I can attest to that, because I have skied there many times. It also has the best powder skiing in the world.)

Multiple sorts are also easy. What if you want to know which ski resorts in Colorado have the most skiable terrain? Or the most vertical feet?

7. Click the down arrow beside the State field. Uncheck Select All, then check Colorado, and click OK.

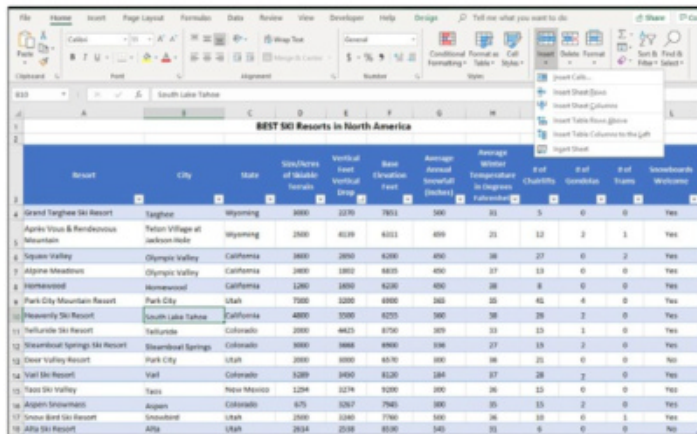
Notice that Excel shrinks the table so only the Colorado ski resorts are visible. Not to worry, the other ski resorts are still there. Once you change the State field back to Select All, the other ski resorts reappear.

8. Next, click the down arrow beside the field called Skiable Terrain. Select Largest To Smallest and it instantly sorts placing Vail at the top with 5,289 acres.

9. Now click the down arrow beside the field called Vertical Feet/Drop. Select Largest To Smallest again and it instantly sorts placing Telluride at the top with 4,425 feet.

Resort	City	State	Size/Acres of Skiable Terrain	Vertical Feet Vertical Drop	Base Elevation Feet	Average Annual Snowfall (Inches)	Average Winter Temperature in Degrees Fahrenheit	# of Chairlifts	# of Gondolas	# of Trams
Grand Targhee Ski Resort	Targhee	Wyoming	4800	3500	6255	500	31	5	0	0
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Deer Valley Resort	Park City	Utah	2000	3000	6570	300	36	21	0	0
Aspen Snowmass	Aspen	Colorado	675	3267	7945	300	35	15	2	0
Taco Ski Valley	Taco	New Mexico	1294	3274	5200	300	36	15	0	0
Vail Ski Resort	Vail	Colorado	5289	3450	8120	104	37	28	2	0

Sort by State, then sort by Skiable Terrain + Vertical Feet.



Easily add new columns and rows.

10. Next, let's add another field called Snowboards Welcome. Move your cursor to the blank column (L) at the far-right side of your table. Type the name of the new column in row 3 and notice that Excel adds the filtering and style format automatically.

11. It's also easy to add new records. Just move your cursor to the bottom of your table and enter a new record on the next available row; for example, enter Snowbird on row 17 and Alta on row 18. Excel formats the style as you type.


CUSTOM-DESIGN TABLES TO LOOK PROFESSIONAL IN A REPORT

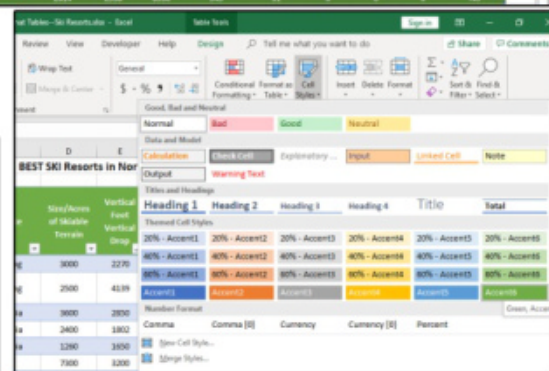
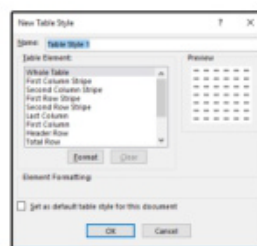
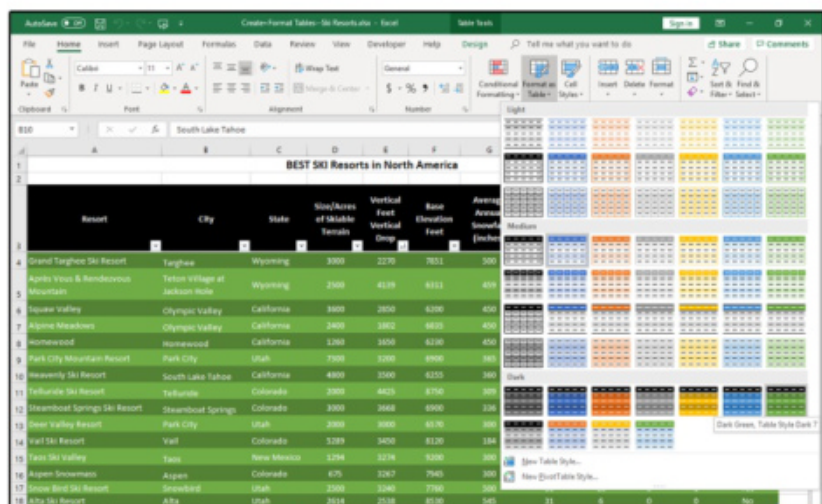
You can easily change the colors and style of your table with just a few mouse clicks.

1. Move your cursor anywhere inside your table.

2. Select HOME > Styles > Styles Table and choose a style design from the large drop-down graphical list.

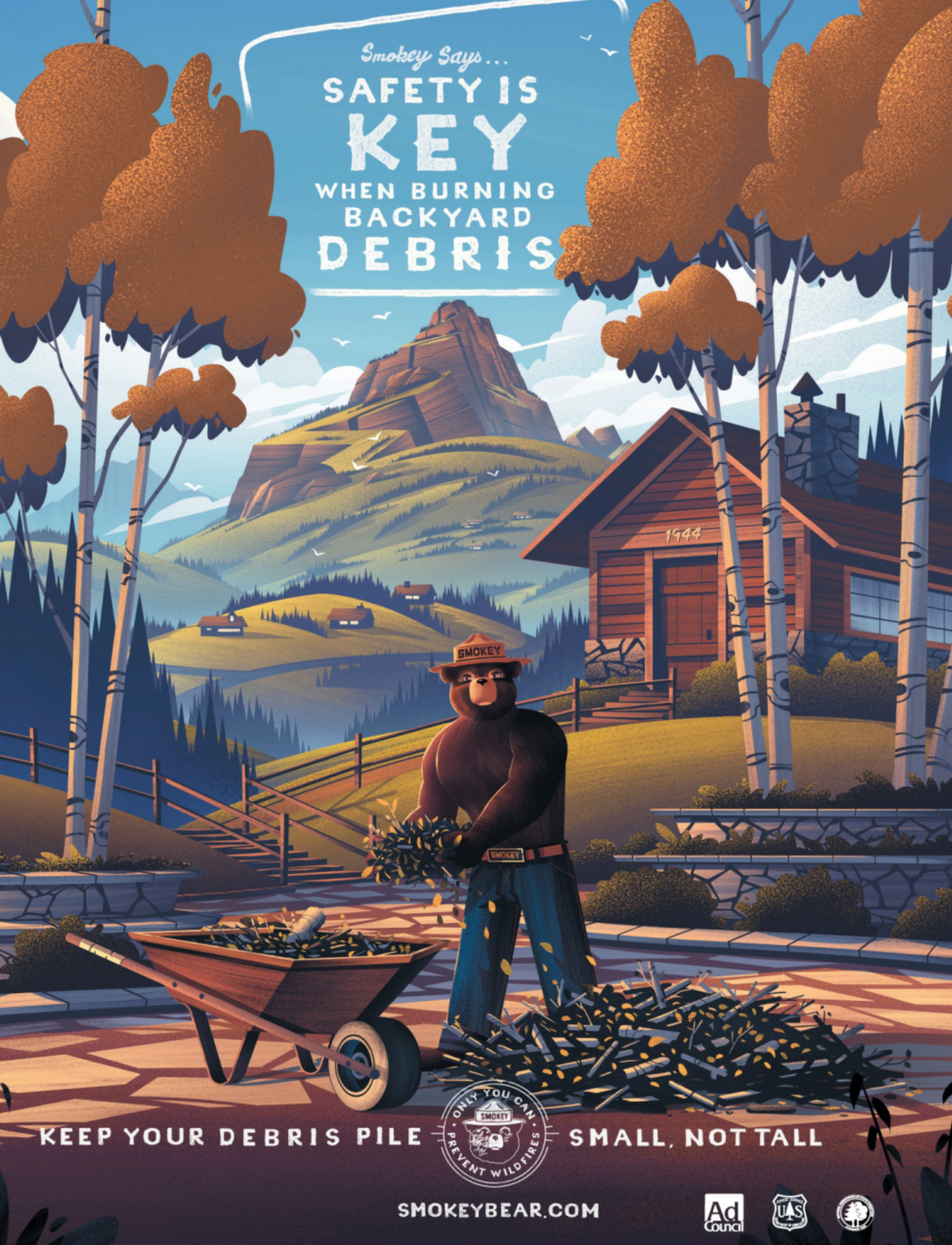
3. You can select New Table Style from the same drop-down list and customize your table design using the features provided in the New Table Style dialog window.

4. You can also customize the individual cells. Just select HOME > Styles > Cell Styles and choose an individual cell design from the large drop-down graphical list. 



Select a custom style format for your new table.

Smokey Says...
**SAFETY IS
KEY**
WHEN BURNING
BACKYARD
DEBRIS



KEEP YOUR DEBRIS PILE SMALL, NOT TALL



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