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FEBRUARY 2017

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WINDOWS 10 CREATORS UPDATE

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Business ready

iX100 wireless mobile scanner

Incredibly fast

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Lightweight

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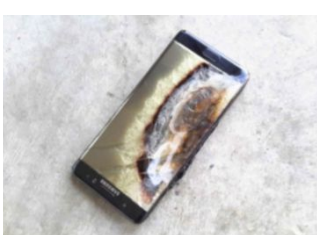

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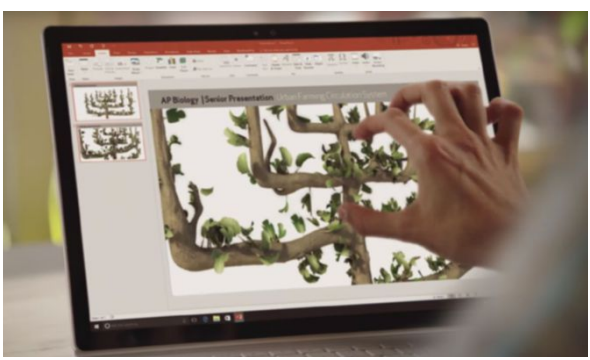

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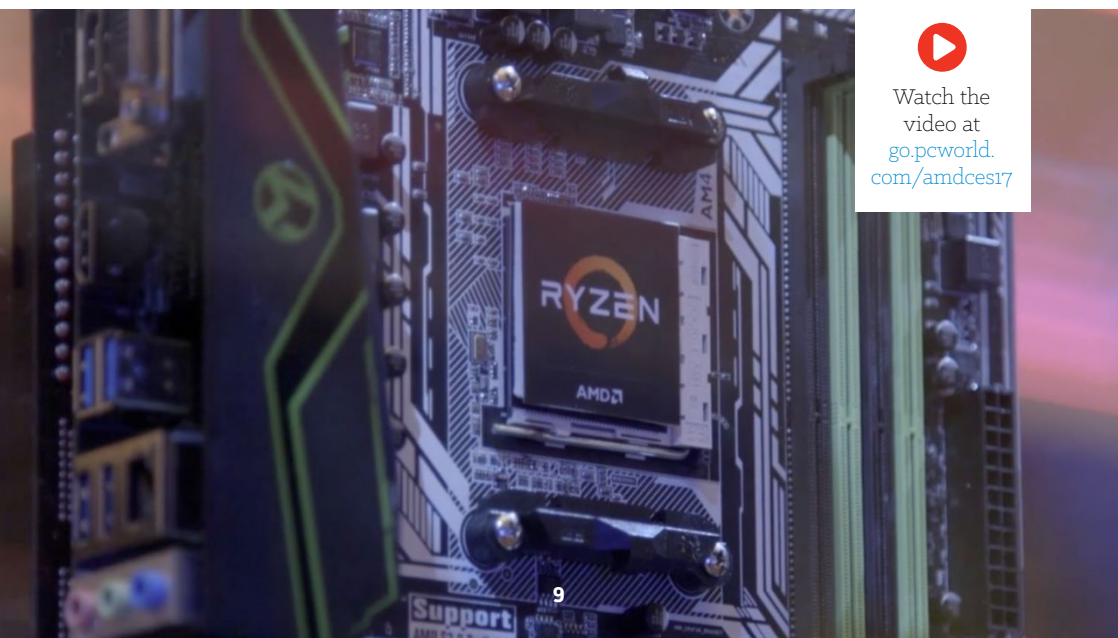
AMD's Ryzen processors will launch before March 3, GDC slip-up reveals

BY BRAD CHACOS

AT THIS POINT, we know a lot about AMD's hotly anticipated Ryzen processors, which look to be AMD's best chip family in a decade. We know some basic specs. We know every Ryzen CPU will be overclockable. We know the chips will have a ton of hardware support at launch—and that AM4 motherboards will last until 2020 at least. The list goes on and on.

One thing we *don't* know? Launch date details beyond a vague "first quarter." At CES, AMD representatives told PCWorld that the target was



Watch the video at go.pcworld.com/amdces17

AMD Ryzen-powered PCs at CES 2017.

not the end of the quarter. But a slip-up in a Game Developers Conference session listing gives greater clarity into Ryzen's arrival timing.

The session's entitled "Optimizing for AMD Ryzen CPU (Presented by AMD)" and it's all about introducing game developers to the Zen architecture's finer details. But the *really* interesting part, as discovered by Anandtech, is the opening sentence in the description: "Join AMD Game Engineering team members for an introduction to the *recently-launched* AMD Ryzen CPU followed by advanced optimization topics."

Recently launched, huh?

The exact time and date for AMD's session are still to be determined, but GDC 2017 runs from February 27 through March 3 so it sounds like we should expect to see whether or not Ryzen's a true Intel rival by March 3 at the latest. (Now if only we knew pricing details.) And while all of AMD's public demos have leaned on a high-end CPU with 8 cores and 16 threads, AMD tells us that an entire chip family will be available at Ryzen's launch.

Speaking of launches, Intel's own Kaby Lake desktop processors just launched during CES. We've got a shootout brewing, folks.

In the meantime, us hardcore hardware lovers in PCWorld's Full Nerd podcast spent a big chunk of our recent CES recap (go.pcworld.com/nerdcesrecap) chatting about AMD's Ryzen—from basic news to deeper analysis to (gasp!) a prediction that it will launch at GDC. Check it out, and follow PCWorld on Facebook and YouTube so you can tune in to the Full Nerd live every other week and ask us your burning PC questions.

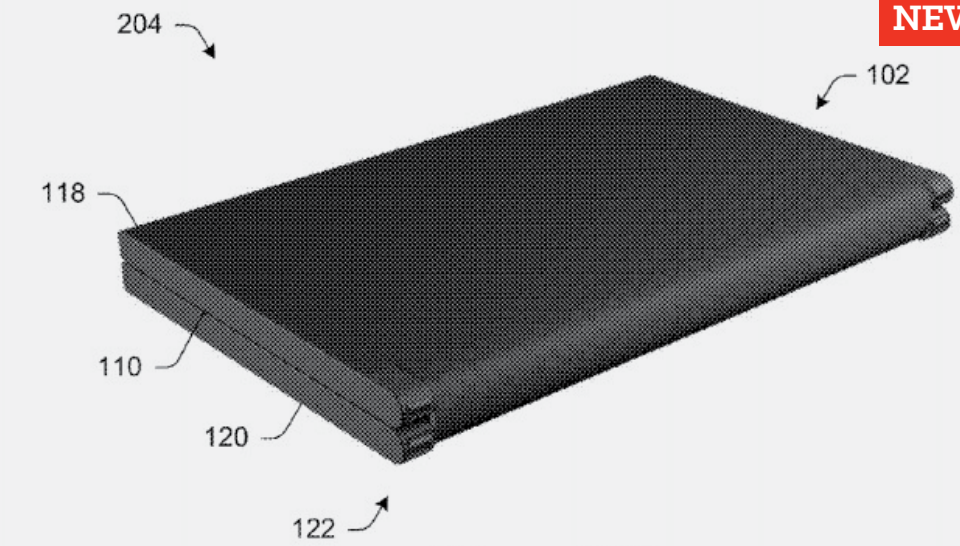


Fig. 2B

A new Microsoft foldable device patent offers more grist for the Surface phone rumor mill

BY MARK HACHMAN

IN 2009, MICROSOFT enflamed the minds of consumers with Courier, a foldable phone/tablet (go.pcworld.com/mscourierf) concept that was eventually cancelled. Years later, a sort-of new patent implies Microsoft hasn't (or hadn't) totally given up on the idea.

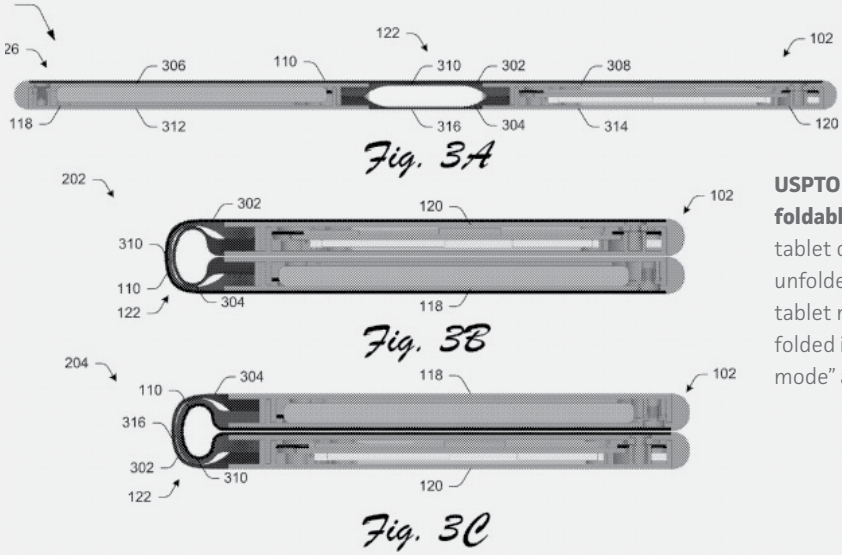
According to the new patent, which was approved on recently, Microsoft envisions a mobile device with a continuous viewing area that extends across the foldable region—similar in spirit to the dual-screen Courier concept.

IMAGE: USPTO

It's an exciting idea, but there's one major caveat: This is a patent from 2014 that the U.S. Patent Office finally approved, not one that Microsoft applied for more recently. As such, it shows that Microsoft was eyeing ambitious, foldable mobile devices at a time when the landscape for mobile computing was much more favorable for Microsoft than it is today. (Remember how Microsoft intended to lure Android phone makers with Windows Phone derivatives like the HTC One M8 go.pcworld.com/htc1m8rev?) Today, Microsoft's mobile market share sits at well under 1 percent, while Android and iOS continue to dominate the mobile landscape.

Nevertheless, Microsoft's patent is intriguing, to say the least. It reasons that phablets represent a poor compromise, straddling a phone's "pocketability" and the large, easy-to-read display of a tablet. Microsoft's patent suggests that a display could be stretched across a hinge, so you'd have the option of a folded, phone-sized device that could be unfolded to reveal a large, thin screen.

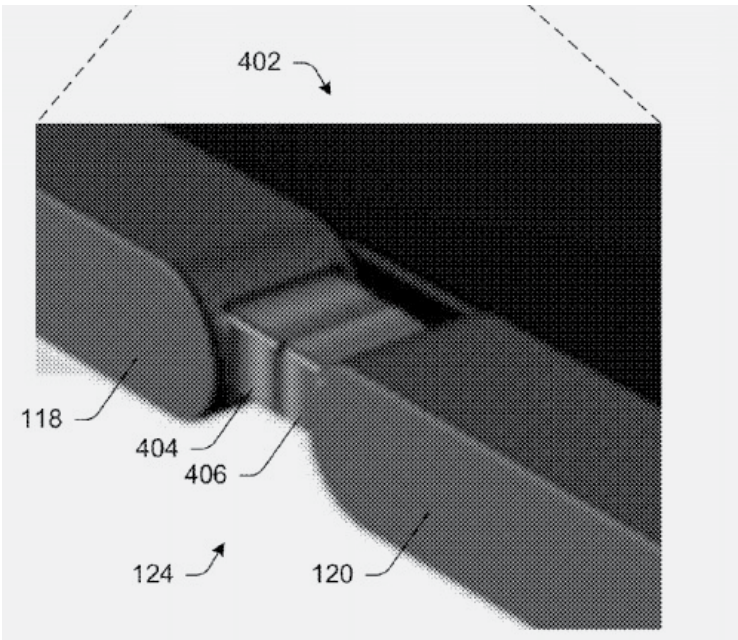
Microsoft has filed what might be called a "broad" patent, suggesting that this arrangement could be configured as both a



USPTO Microsoft's foldable phone/tablet concept: unfolded at left in tablet mode, and folded into "phone mode" at right.

desktop and mobile display, with connections to both an external display as well as an unexplained peripheral device.

Still, the patent doesn't get into some of the nitty-gritty technical details. One question that comes to mind: What to do with the portion of the tablet-sized display that's folded away from view? Displays consume power, and no current display can be partially powered off, just darkened. Unless Microsoft's developed a way to turn off a portion of the display that's not in use, the phone will still be consuming the power of a tablet.



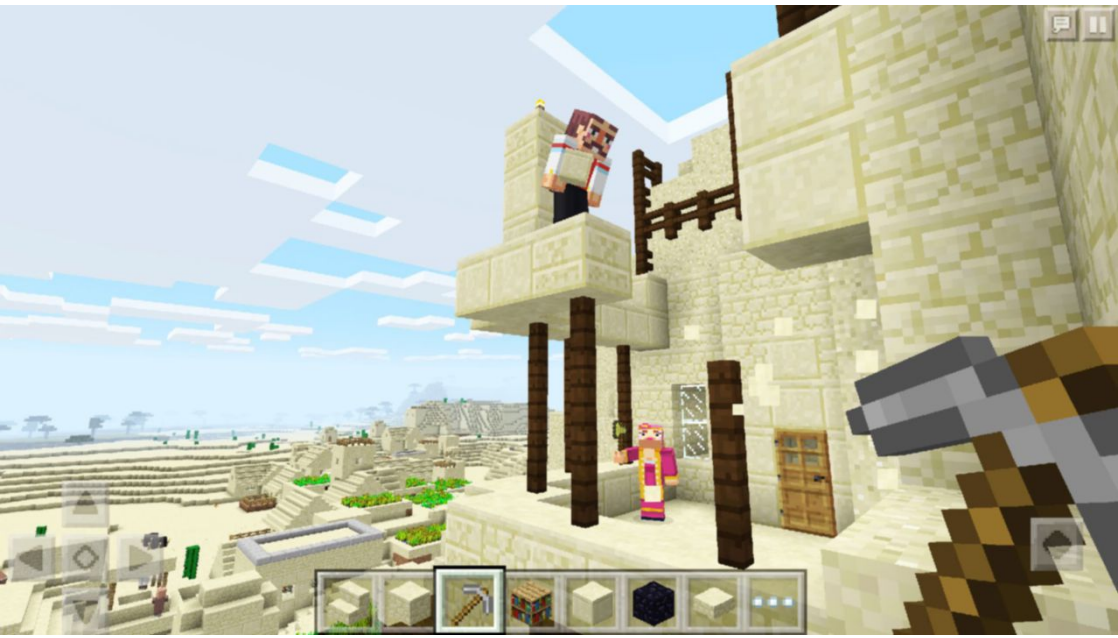
USPTO The hinge that would connect the two halves of the Microsoft concept, creating a seamless display.

Why this matters: Like the El Dorado myth of the city of gold, Microsoft fans haven't given up on the idea that a Surface Phone exists somewhere in the bowels of the company's research labs. Microsoft's patent checks some of the important boxes: It would be a category-defining product in the same vein as the original Surface, and is in line with the current thinking that a Surface Phone won't necessarily be a phone. Right now, this patent approval suggests that there's still a flicker of life in Microsoft's mobile aspirations, and perhaps the Surface Phone. But the cynical viewpoint is that this represents the aspirations of a time gone by, rather than a promise of things to come.

Microsoft halts *Minecraft* updates for Windows 10 phones

BY MARK HACHMAN

MICROSOFT HAS PUT another nail in the coffin of Windows 10 Mobile, confirming that it has stopped development of its hit game *Minecraft* for Windows phones.



Recently, Windows Central reported that Microsoft had halted development of *Minecraft: Pocket Edition* for Windows phones. When asked for comment, a Microsoft representative referred PCWorld to a *Minecraft* support document that indicates the platform won't receive future updates.

The official FAQ states (go.pcworld.com/minecraftpefaq): "Is the 1.0 Ender Update coming to *Minecraft: Pocket Edition* on Windows Phone? Why not?" It goes on to answer: "The 1.0 Ender Update will not be available on Windows Phone 8.1 or Windows Phone 10. Every *Minecraft* platform has different needs and our priority is to focus on long-awaited features for as many players as possible."

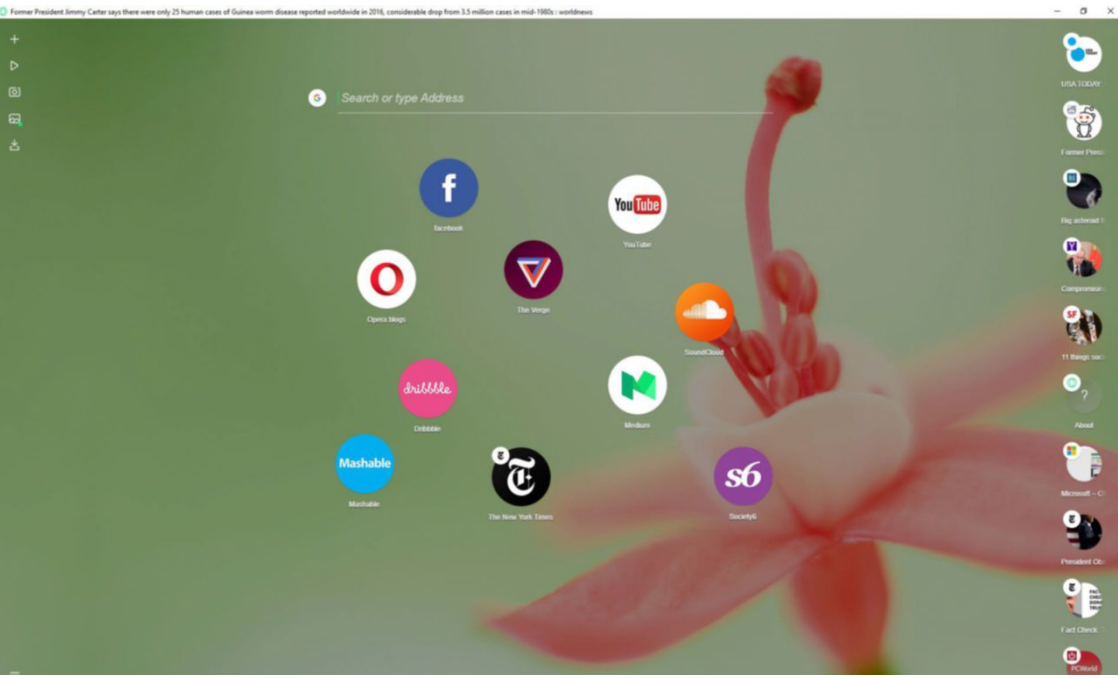
Microsoft's decision means that *Minecraft* development has essentially come to an end for Windows phones. Within Microsoft, *Minecraft* is essentially two games: the original, legacy version based on Java for PCs and phones, which includes the Pocket

Edition; and *Minecraft*: Windows 10 Edition, a C++-based version of the game, which receives the bulk of Microsoft's attention.

Minecraft: Windows 10 Edition—which has exited beta, and whose price rose from $9.99 to $26.99—only runs on Windows PCs, however, and not Windows phones. The only *Minecraft* game that runs on Windows phones is the Pocket Edition, and just the existing version. *Minecraft: Pocket Edition* is still available for iOS and Android, too.

Minecraft: Windows 10 Edition—which has exited beta, and whose price rose from $9.99 to $26.99—only runs on Windows PCs, however, and not Windows phones.

Why this matters: Within the U.S., Windows phone sales are below 1 percent. Not all of those users actively play Minecraft, so you really can't blame Microsoft: The relatively low number of players on the Windows Phone platform ultimately forced its hand. And the company is not alone: the popular exercise app Runtastic pulled support as well. Microsoft's *Minecraft* decision, the demise of Microsoft's Lumia lineup, plus the emergence of productivity-oriented phones like the HP Elite x3 all support one conclusion: The days of consumer Windows mobile phone apps are dying.



Meet Opera Neon, Opera's radical vision for the future of web browsers

BY MARK HACHMAN

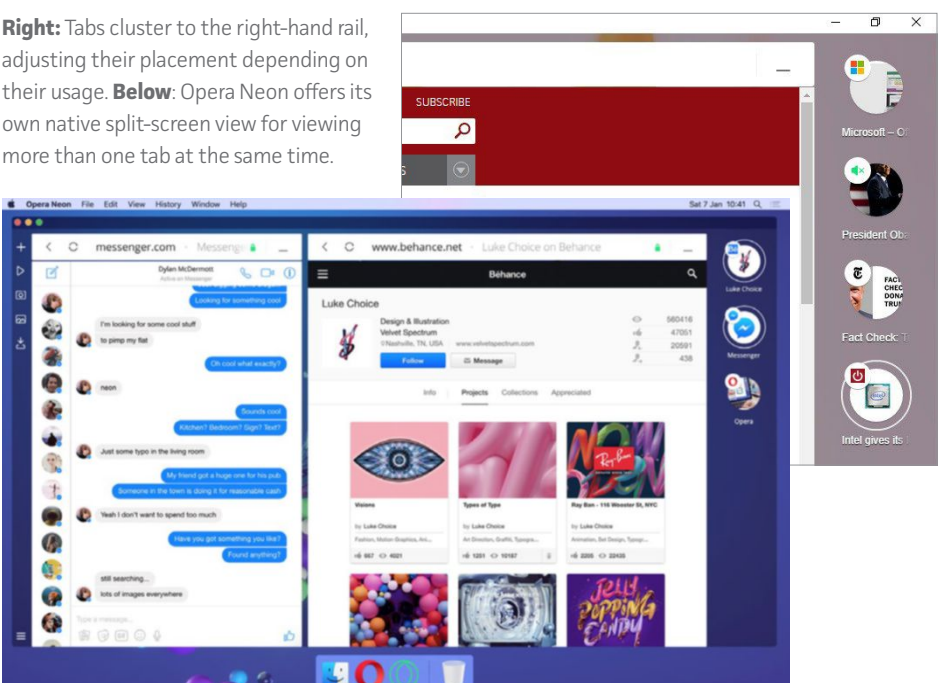
HARDWARE VENDORS SOMETIMES publicize their visions of the future. So do automakers. Now Opera Software is getting into the game with Neon, the company's first concept browser.

Opera's new Neon browser (opera.com/neon) for Macs and Windows PCs isn't game-changing—in fact, rather than a "concept," it feels more like applying a fresh coat of paint. But Opera also succeeds in paring

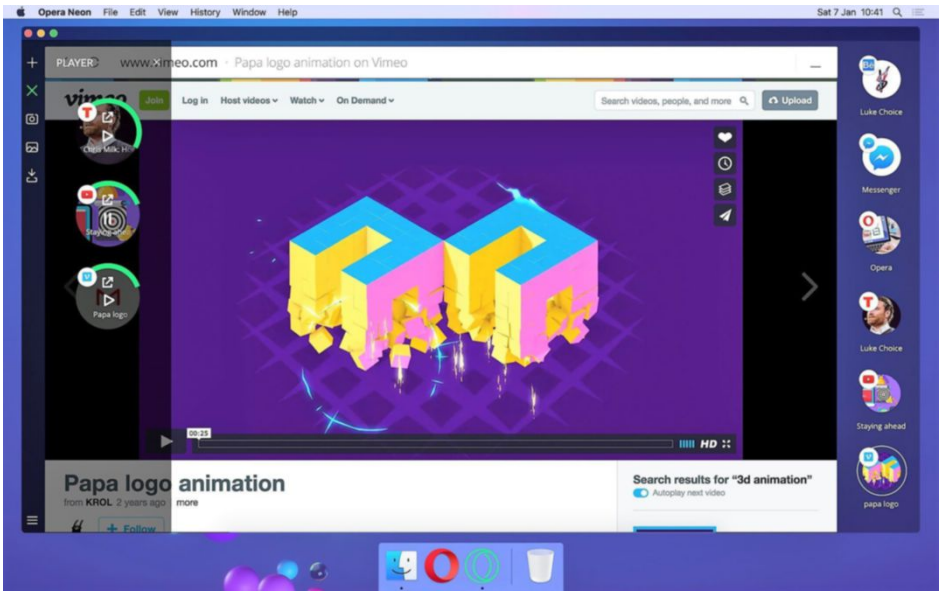
down the browsing experience to a few select tasks. It's a refreshingly attractive design, as Neon's background blends into your desktop, and circular tabs consciously contradict the sea of rectangles that rival browsers employ.

With that said, Opera Neon won't replace the existing Opera browser. In fact, Neon is arguably less full-featured than Opera's existing browser, which includes native capabilities like ad blocking (go.pcworld.com/operablock). Opera did say, however, that it plans to migrate some of Neon's new features to its mainstream browser sometime this spring.

Why this matters: In its current form, Opera Neon is little more than a curiosity. But it's an important vehicle for showing what the Web could evolve into. Personalization options like Opera's own themes (go.pcworld.com/operathemes) and Firefox's comprehensive "complete



Right: Tabs cluster to the right-hand rail, adjusting their placement depending on their usage. **Below**: Opera Neon offers its own native split-screen view for viewing more than one tab at the same time.



themes" (go.pcworld.com/ffthemes) only go so far. Microsoft had a chance to demonstrate the future of the Web with Edge, and companies like Brave (go.pcworld.com/braveb) are working behind the scenes to bring their visions to market. Neon is Opera's chance to do the same thing.

Videos can be broken out from their main page and "stored" under the video tab.

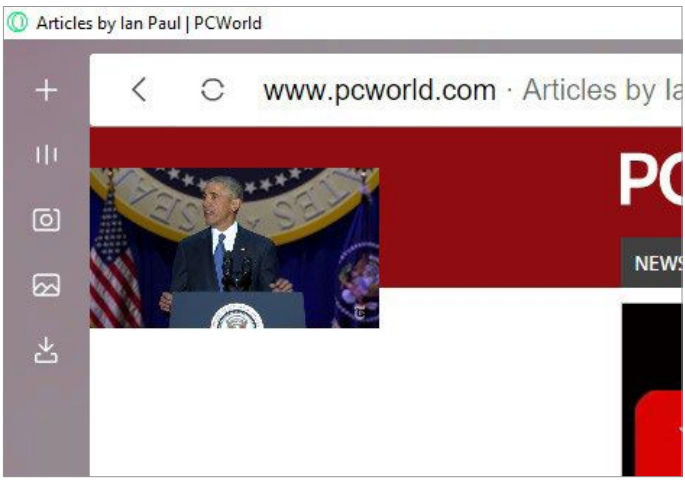
A fresh, clean look and feel

Opera Neon opens with an arty "homepage," listing your most frequently accessed pages—or, upon first launching it, the pages Opera thinks you might like to view. Rather than use a custom background, Neon simply uses your existing desktop background to appear less obtrusive.

Instead of squares or rectangles, icons are circular, often highlighting either the Web page's logo—or in the case of a specific article, the primary piece of art the page is built upon. If you do have a article open, however, the "favicon"—the small icon that a brand is based upon, like the Twitter bluebird—hovers off to one side. There's also a slightly

tweaked "omnibox," Opera's search box.

Although the traditional orientation is to keep adding tabs across the top of the browser window, Neon adds them in a vertical column to the right of the browser window. Opera says that the tabs will operate as if affected by gravity, with frequently-used tabs rising to the top, while little-used tabs sink like a stone.



A closer look at Neon's left-hand nav bar and floating video window.

Features that you might find in other browsers, though—like previewing the tab by hovering your mouse cursor over it—simply aren't present, making Neon more a celebration of form over function.

The left-hand nav bar is reserved for five icons: a "+" to add another tab, a series of vertical lines that hide a video player, a "camera" icon to take screenshots with, a "painting" icon that links to a gallery of those snippets, and a download icon at the bottom. Like Opera's mainstream browser, the "video player" can be used to separate a video window from the rest of the tab, allowing you to watch a YouTube video, for example, while you shop online. (If a video is playing, the icon ripples, and the favicon on the source tab changes so that you can track down which tab is playing the video.) The "camera" icon also provides a convenient way to highlight and save all or a portion of the screen.

Otherwise, though, that's about the extent of Neon. Opera's concept doesn't really justify the download, though it's attractive enough. What's more interesting is if Opera eventually uses Neon as its proverbial garage, hacking together new concepts to see what works and what doesn't.

Sony's Bravia OLED: the first flat-screen TV with sound that doesn't suck

BY MICHAEL BROWN

THERE'S BEEN A fair amount of discussion about the two key technologies in Sony's new Bravia XBR-A1E series of OLED smart TVs, so we reached out to Sony for clarification. A company spokesperson confirmed that Sony does not manufacture the A1E-series' OLED panel, but declined to say where the panels are being sourced from.

Declining to identify suppliers is not an uncommon practice in any industry, but it doesn't take much imagination to speculate that Sony is

sourcing its OLED panels from LG Display, which also provides the OLED panels for Panasonic's THX-certified Viera TX-65CZ950 smart TV. (go.pcworld.com/vierathx) LG Display started out as a joint venture between LG Electronics and Philips Electronics and is now an independent, publicly traded company.

The Sony spokesperson went on to say that the OLED panel is just one factor contributing to the A1E-series' display performance, that Sony's X1 Extreme processor and the software running on it is a key differentiator.

As for Sony's Acoustic Surface technology, which is the focus of this article, the spokesperson said "While LG is working on a version called 'Crystal Sound,' the Acoustic Surface technology was developed solely by Sony. Using an actuator to produce sound is generic principle technology, but to my knowledge the A1E series is the first large screen TV using this type of sound technology. A patent is now pending."

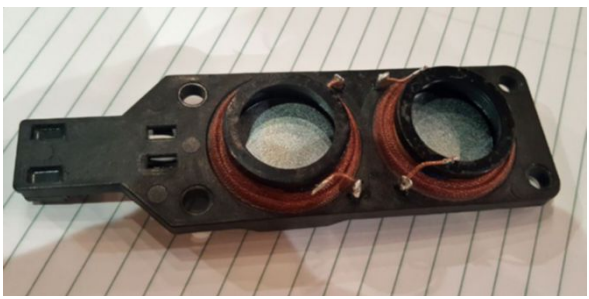
Sony had just one OLED TV in its lineup prior to CES, a 30-inch model that it sold to Hollywood professionals for $18,000 a pop. Now it's found a reason to build a consumer OLED to compete with its arch-rival and longtime OLED proponent LG: a new audio technology that transforms an entire OLED panel into a giant speaker.

The company invited me to what it described as a "black box demo" to see its pride and joy: The Bravia A1E OLED. I was directed to a warren of enclosed, all-black cubicles with no signage or branding that was that was hundreds of feet away from

Sony's Bravia XBR-1AE photographed on the show floor. Note how thin the OLED panel is, with all of the TV's electronics mounted inside its easel-like stand.

Sony's huge CES exhibit. It was like entering the Area 51 of CES.

Ushered inside one of these rooms with four other tech journalists, I was introduced to the the lead engineers who created the XBR-A1E. Their demo started with audio performance, and that's the focus of this article. The XBR-A1E delivers a stunning picture—the best I've seen from *any* type of TV—but its audio performance is what really blew me away.



Each mount has two actuators, with one mount on the left-hand side of the display and the other on the right-hand panel.

For years, the TV industry has been battling it out to see who can build the thinnest possible TV. As the panels have become skinnier and the bezels have retreated from the edges of the glass, there's literally nowhere left to mount speakers. Most companies put them at the bottom of the display, making the bezel taller in that one place to accommodate them; but when they do that, the image displayed on the screen can reflect on the bezel and create a visual distraction. Even then, the speakers so small that they sound reedy and weak because there's no meaningful enclosure for them to resonate in. Bass response? No way.

Sony's solution? Turn the entire OLED panel into a high-frequency speaker by mounting four "actuators" on the back of the panel itself, two on the left side and two on the right. The devices are similar to the transducers used in the manufacture of some flat loudspeakers. And as is the case with transducers, Sony's actuators need to be supplemented with a more conventional cone woofer to deliver bass response. In the case of the Bravia XBR-A1E OLED, a 6cm subwoofer is embedded in the TV's easel-like stand along with the rest of the TV's electronics.

Touch the panel itself while audio is playing, and you can feel the OLED vibrate. Amazingly, the vibration doesn't introduce jitter into the picture. What's more, the audio follows the video and is tied closely to the action on the screen. If an actor on the screen moves from left to

right across the screen while speaking, the actor's voice will pan across the screen with them. The XBR-A1E's audio performance has to be heard to be believed.

The XBR-A1E's 6cm subwoofer is mounted at the top of it's easel-like stand.

Sony's audio magic won't convince any of us who've invested in home-theater audio equipment to give up our A/V receivers, stand-alone subwoofers, and multiple discrete loudspeakers no matter how innovative Sony's actuator tech might be. But for someone who wants to hang a high-end TV on the wall and get good sound without resorting to hanging a boxy sound bar underneath it, it will probably be more than good enough.

We hope to get an XBR-A1E-series TV when it goes on sale later this year (Sony hasn't announced pricing or availability). We'll be able to deliver a more studied opinion then.

Gabe Newell's Reddit Q&A: on Half-Life 3, Steam support, and more

BY HAYDEN DINGMAN

VALVE FOUNDER GABE Newell took to Reddit recently for another hour-long AMA/Ask Me Anything (go.pcworld.com/gnewellama) session. Among the topics broached: Is Valve still working on singleplayer games? What are its plans for the future? And the perennial "What is up with Steam support? Why is it so bad?"

The timing is pretty fortuitous. Recently *Game Informer* published an interview with an alleged Valve insider, one who subsequently claimed *Half-Life 3* would never happen. And as per usual, *Half-Life 3* was the topic of many dodged questions, though Newell did say "I personally believe all unidentified anonymous sources on the internet" when asked about the article. Good ol' sarcasm.

Despite the absence of *Half-Life 3*, Newell did confirm that Valve hasn't abandoned its game development roots, responding to "Is Valve still working on any fully-fledged singleplayer games?" with a simple "Yes." (Via Reddit user *Baldemoto*)

More clues lie in other posts. Asked about the Source 2 engine (by *The_Four_Leaf_Clover),* Newell said "We are continuing to use Source 2 as our primary game development environment. Aside from moving *Dota 2* to the engine recently, we are are using it as the foundation of some unannounced products."

And when asked by user *Air_chandler* what direction Newell would like to see Valve go in the future, he replied:

"The big thing right now is broadening the range of options we have in creating experiences. We think investing in hardware will give us those options. The knuckles controller is being designed at the same time as we're designing our own VR games."

The big thing right now is broadening the range of options we have in creating experiences. We think investing in hardware will give us those options.

Presumably the "knuckles controller" is the Oculus Touch-style prototype Valve demoed at Steam Dev Days (go.pcworld.com/valvesdd) in October. And with Valve's in-house project "The Lab" still being one of the most polished and interesting experiences for the HTC Vive, news of other projects is more than welcome. Hopefully we'll see something at the Game Developer's Conference in late February-Valve and the Vive have had a big presence there the last two years.

Steam's support and quality control were also hot-button issues. Newell mentioned support *numerous* times during his hour, though the lengthiest reply (to user *rinnagz*) delved into concrete milestones.

"Since the last AMA, we've introduced refunds on Steam, we've grown our Support staff by roughly 5x, and we've shipped a new help site and ticketing system that makes it easier to get help. We've also greatly reduced response times on most types of support tickets and we think we've improved the quality of responses. We definitely don't think we're done though."

Definitely some important changes, though complaints with Steam's support crew (long wait times in particular) have only grown as the store's become more popular.

As for quality control, don't expect the flood of shovelware to stop

anytime soon. When asked about it by *ImpatientPedant,* Newell's response was: "There's really not a singular definition of quality, and what we've seen is that many different games appeal to different people. So we're trying to support the variety of games that people are interested in playing. We know we still have more work to do in filtering those games so the right games show up to the right customers."

That's not the most encouraging answer considering the amount of low-effort garbage cluttering up Steam these days. On the other hand, the anything-goes approach is probably better (and more sustainable) than Valve's old heavily-curated system. Not only is it less burdensome for Valve employees, there's more chance of something unknown like *Stardew Valley* breaking through and becoming a surprise hit.

The knuckles controller?

Anyway, those are the salient details, though there's quite a bit more thread to mine. Small things, like Newell saying he's interested in studying "brain-computer interfaces," confirming that the *Half-Life* and/or *Portal* movies are still in the works, or discussing his regrets when it comes to the original *Half-Life*. Conspicuously absent: Any mention of Steam Machines. I recommend browsing through it if you're interested, as it's both an interesting look at a notoriously reclusive company and pretty much all the candid communication we can expect from Valve for the next four years or so.

Nintendo Switch console details revealed

BY HAYDEN DINGMAN

IMAGE: NINTENDO

AND JUST LIKE that, we've officially entered Generation 9 for gaming consoles. Nintendo pulled back the veil on the Nintendo Switch (nintendo.com/switch/buy-now), its upcoming handheld/stationary hybrid console and successor to the underwhelming Wii U.

First up, the important bits: The Switch will launch worldwide on March 3—yes, less than two months from now—for a suggested retail price of $299.

I say that's the important bit because we pretty much knew everything else about the console from Nintendo's October reveal. The Switch name refers to the device's dual nature, both a traditional TV console and a mobile handheld. In its "docked" form, the Switch looks quite a bit like a Wii—a vertically oriented rectangle that connects up to your TV with an HDMI cable. The accompanying Joy-

Con controller looks fairly traditional as well, like a blockier Xbox gamepad complete with offset analog sticks.

Appearances are deceptive, though. You can actually remove the core of the Switch, revealing a tablet with a capacitive touch screen. And the controller? It breaks apart also, the two edges sliding out of the central "Joy-Con Grip" and attaching onto the sides of the tablet, basically recreating the Wii U controller. You can then take the Switch out into the world, with Nintendo touting between 2.5 and 6 hours of battery life. That's a *huge* spread, so probably err on the side of 2.5 for most gaming purposes.

And there's a third way to play. Turns out the individual Joy-Con controller pieces also replicate the motion control functionality of the Wii, albeit in a smaller form factor.

This last format actually took center stage as the press conference opened, courtesy of two experimental games: *1-2-Switch* and *Arms*. The pair look like standard Wii-era party games, with *1-2-Switch* having you duel your friends in a variety of mini-games while *Arms* has you fighting with...well, extendable arms.

It's fair to say most people came into the press conference just looking for a new *Zelda* and *Mario* though, both of which were revealed. *Zelda: Breath of the Wild* takes precedence, as it's one of the

It breaks apart also, the two edges sliding out of the central "Joy-Con Grip" and attaching onto the sides of the tablet.

IMAGE: NINTENDO

few (four, apparently) launch games releasing alongside the Switch on March 3—finally tacking a date on a project everyone expected would release years ago.

Oh, and it's coming to the Wii U also, if you have one of those around and prefer not to buy into the Switch too early.

Super Mario Odyssey will arrive winter of 2017, and it seems suitably bizarre. The cartoon style the series has sported since the Nintendo 64 days has been blended with a lifelike cityscape, and the result is weird, cool, and maybe a bit uncomfortable.

There's also a new *Splatoon* sequel, bringing the Wii U's hit squid-kid shooter to Nintendo's new console. The only problem? As of this fall, Nintendo will start charging for the Switch's online features. Hence *Splatoon* might finally get released to a larger audience, but still be hobbled if nobody chooses to pay for Nintendo's likely-shoddy

IMAGES: NINTENDO

Watch the video at go.pcworld.com/switchpresvid

multiplayer support.

As for third party publishers, Nintendo ran through announcements for *Shin Megami Tensei*, *Xenoblade*, *No More Heroes*, *Skyrim*, and *FIFA*, plus a highlight reel of a few other games (including Ubisoft's recent snowsports sim *Steep*). Nothing really to make you think third-party support will be a critical part of the Switch's life cycle, but that's par for the course by now when it comes to Nintendo.

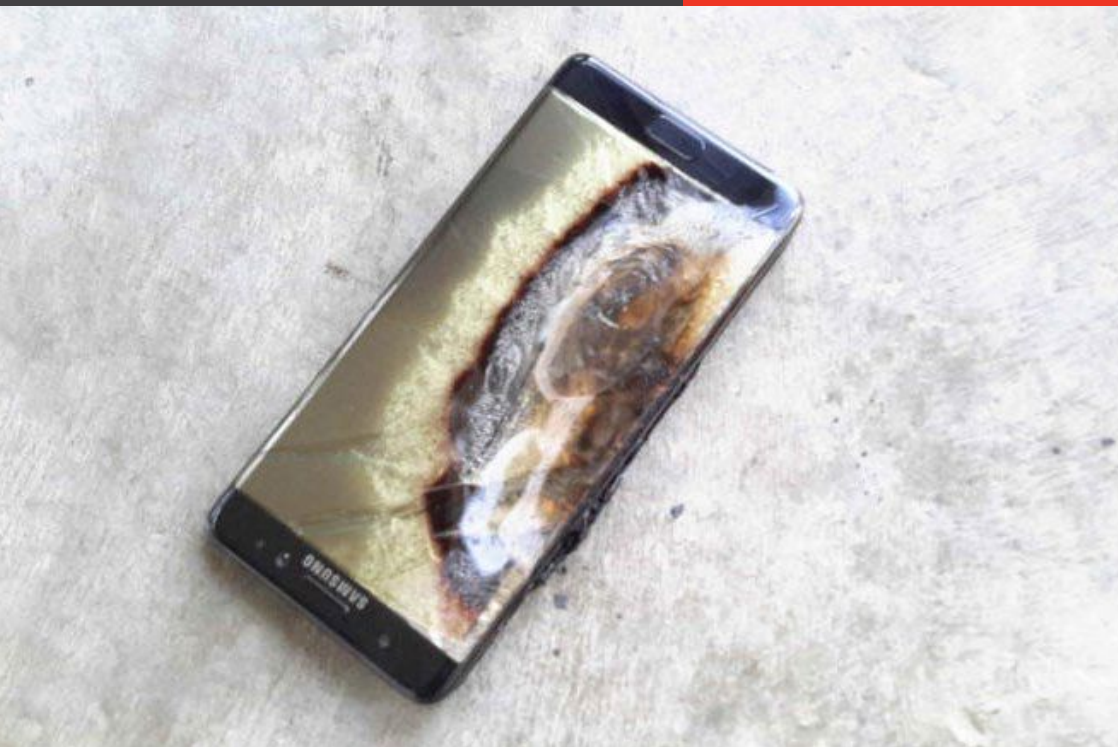
And therein lies the rub, eh? After four years of the Wii U underperforming, there wasn't much in Nintendo's presentation to suggest it'll do otherwise—except for the presence of *Mario*and *Zelda*. If you're a fan, great, buy it for those.

Like the Wii and Wii U though, the Switch seems like it'll be used mostly for first-party titles and nothing else. We didn't get any discussion of the Switch's internal specs, but the games we saw looked more on-par with the Wii U than the launch PS4 and Xbox One—let alone the updated PS4 Pro and the Xbox's upcoming Scorpio refresh. Don't expect many tent-pole game releases to be ported to the Switch.

Internal storage is also something I'm curious about, given the undersized hard drives inside the PS4 and Xbox One. With the Switch being part tablet, I can't imagine there's much drive space, especially at $300. Could be interesting.

All in all, it's a Nintendo console with Nintendo games. For some people that'll be enough. For others, not so much. Not exactly the stunning endorsement some Nintendo fans hoped for, but it's probably what we could've guessed. Head over to Nintendo's site (nintendo.com/switch/buy-now) for more information, including the cost of replacing the Joy-Con controllers (a whopping $80 a pair) and more.

IMAGE: NINTENDO



You won't have to hear about the Galaxy Note7 on flights anymore

The FAA has lifted the requirement for airlines to notify passengers of the Samsung Galaxy Note7 ban as nearly all units are returned.

BY MICHAEL SIMON

SINCE ITS LAUNCH in September 2016, the Galaxy Note7 went from being the phone to beat to the one you couldn't take on airplanes. Even with a global recall in place and a series of software updates designed to brick any remaining devices, the FAA continued its ban on Samsung's phablet, and frequent travelers grew accustomed to hearing about the warning before take-off.

With the recall nearly complete, the U.S. Department of Transportation has announced that those announcements are no longer necessary. In a press release, the Federal Aviation Administration said that while the ban remains, the DOT has "removed the requirement for air carriers to specifically notify passengers about the Note7 phone immediately prior to boarding due to the high degree of public awareness of the ban since issuance of the emergency restriction/prohibition order, as well as the extensive efforts by Samsung and U.S. wireless providers to make all Note7 users aware the phone is recalled and banned from transport on U.S. aircraft."

Samsung revealed that more than 96 percent of the devices had been returned.

In a separate release, Samsung revealed that more than 96 percent of the devices had been returned.

Recently, Samsung announced it would be pushing out a software update that would prevent the ability to charge Note7 batteries, the last of which was due to arrive Jan. 8. Despite Samsung's efforts, however, the Note7 remained a major headache for travelers. In December, a Virgin Atlantic flight to Boston was nearly grounded after someone renamed their portable Wi-Fi hotspot SSID to "Galaxy Note 7_1097" as a prank.

Reports say that the device's extreme thinness likely contributed to the explosions, but Samsung has yet to publicly release the results of its investigation. At its CES keynote presentation, Tim Baxter, president and chief operating officer of Samsung Electronics America, addressed the debacle and said the company would be releasing its findings soon:

"Some of you were directly impacted and certainly many of you saw the media coverage surrounding the Galaxy Note 7. We continue our intensive efforts internally and with third-party experts to understand what happened and to make sure it does not happen again."

Why this matters: The effect of the Note7 saga has been felt far beyond the millions of people who bought one, and airline passengers will be able to rest a little easier knowing that there are fewer and fewer devices out there to risk disrupting their flights. And now that nearly all of the handsets have been returned, Samsung needs to explain what happened and the steps being taken to ensure it will never happen again as it continues to work to repair consumer trust.

Windows 10's privacy settings will be simpler with Creators' Update

BY MARK HACHMAN

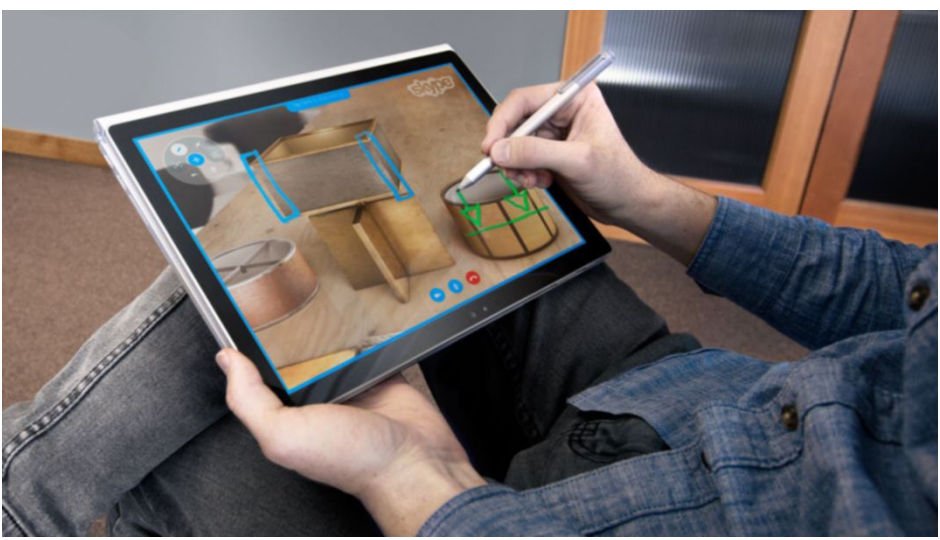
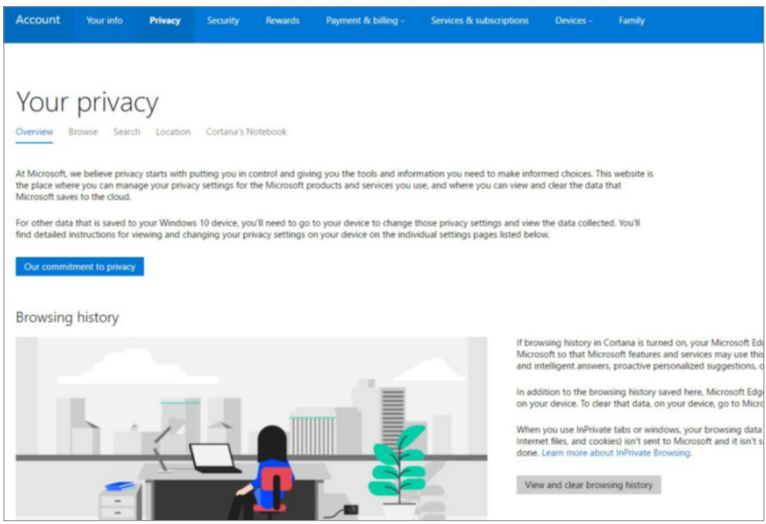


IMAGE: MICROSOFT

MICROSOFT SAID RECENTLY that it plans to simplify the privacy options in the upcoming Creators' Update, though some may see one component as limiting user choice as well.

Microsoft plans to revamp how privacy is managed in the upcoming Creators Update to Windows 10, both as part of the initial setup as well as the amount of data it collects in day-to-day diagnostics. That amount will actually decrease, if a user so chooses. But Microsoft has also eliminated an intermediary option, forcing the user to choose whether to provide Microsoft minimal or "full" access to their PC.

If that all seems somewhat confusing, Microsoft also said it has dedicated a new page to explaining what data it collects, and how to erase that data from Microsoft's service. The new privacy dashboard (go.pcworld.com/msacctprivacy) is available online, and accessible if you're logged in with your Microsoft account.



Microsoft's new online privacy dashboard.

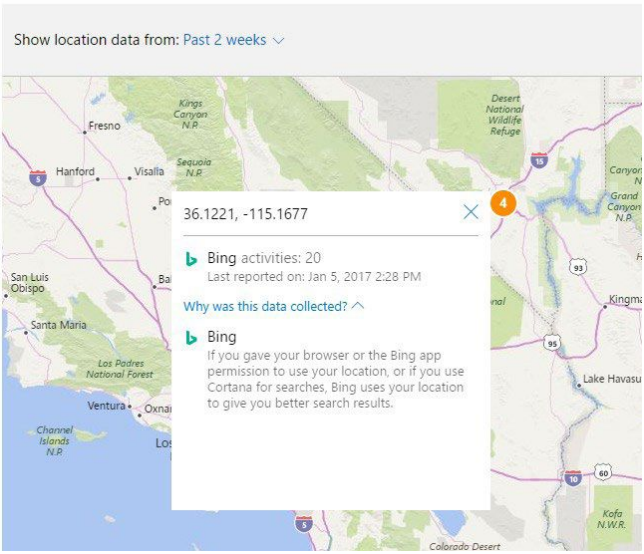
Why this matters: Most people aren't really sure what data the devices they use collect about them—though they rarely hunt that information down. Google provides a nicely organized page about the data it collects, including an Activity Controls page that offers data privacy controls similar to what Microsoft is launching. Apple does a much poorer job, basically tossing a ream of legalese at the user. In any event, any free service is often paid for by your private data. Google and now Microsoft are making that transaction somewhat more transparent.

Microsoft's privacy dashboard

Microsoft's new privacy dashboard isn't entirely new. The company has always allowed users to access and manage the data collected by Windows 10. Enterprises have even more control. But the new dashboard puts this all in one place, online, with simple language that explains what's going on. More importantly, users can decide to block or erase that data.

For example, here's what Microsoft showed me about my recent trip to Las Vegas to cover CES:

The new Web dashboard allows you to review and optionally clear access to your browsing history, Bing search history, location activity, Cortana's Notebook, and Microsoft Health, if you own one of the devices that can connect to the service. There's also a link to Microsoft's overarching privacy policy.



Microsoft's location data didn't track my devices to Las Vegas, though it showed them present in my home in California.

"At Microsoft, we believe privacy starts with putting you in control and giving you the tools and information you need to make informed choices," the company's site states. "This website is the place where you can manage your privacy settings for the Microsoft products and services you use, and where you can view and clear the data that Microsoft saves to the cloud."

Privacy changes in the Creators' Update

In a couple of months, Microsoft plans to roll out the Creator's Update, which it's slowly rolling out to Windows Insiders via a series of new builds, including a massive one recently (go.pcworld.com/w10prv15002). Every time you install Windows—or a major update like the Anniversary Update or the CU—Microsoft typically asks you to review your privacy settings. In each case, you have the option to allow Microsoft to manage them—known as Express Settings—or to customize them yourself.

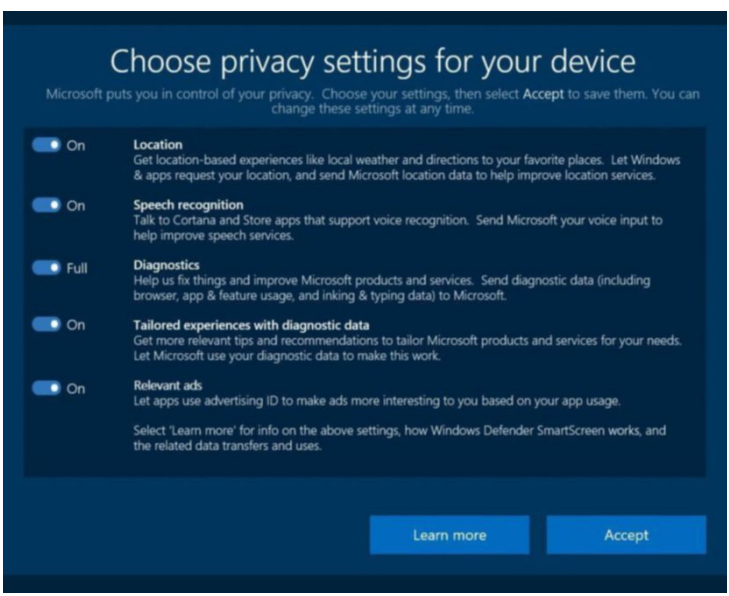
With the CU, it appears, Express Settings will be replaced by a series

of toggle switches (enabled by default) that will still give you the option to customize them. Each switch—governing location, for example—will briefly explain what sort of data it collects.

If you toggle off a privacy component, blocking the data from being sent to Microsoft, the toggle will explain the consequence of that action. Microsoft obviously wants you to leave that switch toggled on, but at least it will provide information both for and against your decision. Your privacy decision, though, is flexible. You can currently go to Settings > Privacy > Location to toggle on and off your device's location tracking. (The new online privacy dashboard also adds another option.)

But Microsoft's revamped privacy options actually strip away a choice in one key aspect of Windows 10's day-to-day operations. Under Settings > Privacy > Diagnostics And Feedback, you have three options to send Microsoft details of how you use your PC: Full (the recommended, default setting), Enhanced, and Basic. Microsoft explains what each setting does, but here's the bottom line: The middle Enhanced setting is going away with the Creators' Update, forcing you to choose whether to send a minimal amount of data to Microsoft, or virtually everything.

If you opt out of sending data, Microsoft explains (in its view) why it's a bad idea.



Microsoft has also stripped out some data from its Basic diagnostics tier,

including application usage data. A Microsoft spokeswoman called all the data it collects "vitally important to the provision of Windows," but decided to shift some of its data collection to the Full tier.

"One of the most significant things we removed from Basic is application usage data," the Microsoft representative said in a statement. "How applications are performing and interact, and how that affects things like battery life and system performance, is still extremely important for us to understand in order to provide a quality operating system. Application usage data and other items we removed from Basic are now being collected at the Full level."

"One of the most significant things we removed from Basic is application usage data," the Microsoft representative said in a statement.

Whether that's of concern to you probably depends on where you stand on privacy issues. If you opt for the Basic route, Microsoft is technically collecting even *less* data than before. If you find yourself talking to technical support quite often, though, and provide supplementary data to troubleshoot problems, you might have more concerns.

The point that should be made, however, is that Microsoft is making this conversation public, rather than downplaying it or even generally ignoring it, as Apple does. "We are continuing this commitment to make it as easy as possible for you to make informed choices about your privacy with Windows 10," wrote Terry Myerson, executive vice president of Windows and Devices, in a blog post. That's a good thing.

IMAGE: ADAM PATRICK MURRAY

Consumer Reports updates its MacBook Pro review

BY ROMAN LOYOLA

IN JANUARY, CONSUMER Reports and Apple revealed that a bug in Safari caused erratic battery life test results in Consumer Reports' testing, which resulted in the first Apple laptop to not receive a recommendation from the publication. Consumer Reports has finished its retesting, and announced that it has revised its review to reflect a recommendation (go.pcworld.com/mbpcr) for the new MacBook Pro.

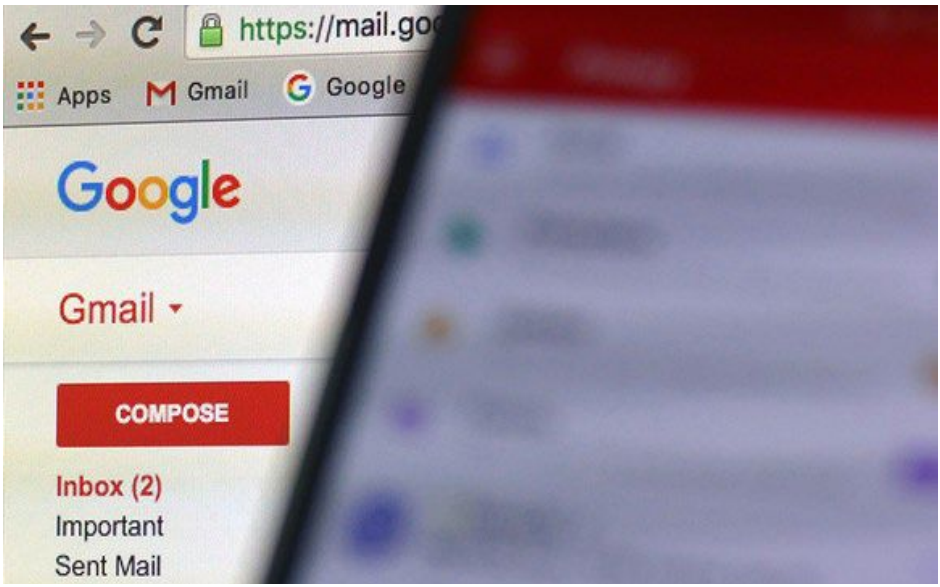
After discovering the Safari bug, Apple created a fix, and Consumer Reports reran its battery life test. On its website, Consumer Reports said that the new MacBook Pro, "all performed well." The publication tested a 13-inch Touch Bar model, a 13-inch non–Touch Bar model,

and a 15-inch model. The retests resulted in battery life of 15.75 hours, 18.75 hours, and 17.25 hours, respectively.

These test results far exceed Apple's stated battery life of up to 10 hours each for "wireless web" access and "movie playback." Consumer Reports has stated that its tests aren't designed to replicate real-world usage; they're designed to so that the results can be compared across different platforms. For example, Consumer Reports sets the laptop display to 100 nits, which is so dim that it can only be comfortably used in a dark setting. But it's also a setting that helps save battery life.

The Safari bug that was discovered during testing has a fix that Apple has released in a beta version through the Apple Beta Software Program (beta.apple.com/sp/betaprogram). The bug occurs only if you are using Safari in Developer mode, and if you disable caches. The fix will be released to the public once the beta cycle is done.

Read more: *Macworld*'s review of the 2016 MacBook Pro with Touch Bar (go.pcworld.com/mbptouchrv).



CREDIT: MARTYN WILLIAMS

Privacy legislation reintroduced for mail older than 180 days

BY JOHN RIBEIRO

A BILL HAS been reintroduced in the U.S. House of Representatives that would require that law enforcement agencies get a warrant before they poke around users' emails and other communications in the cloud that are older than 180 days.

The Email Privacy Act, reintroduced recently, aims to fix a loophole (go.pcworld.com/hr699) in the Electronic Communications Privacy Act that allows the government to search without warrant email and other electronic communications older than 180 days, stored on

servers of third-party service providers such as Google and Yahoo.

"Thanks to the wording in a more than 30-year-old law, the papers in your desk are better protected than the emails in your inbox," digital rights organization, Electronic Frontier Foundation said in a blog post.

The bill was passed by the House of Representatives last year but stalled in the Senate.

Representatives Kevin Yoder, a Republican from Kansas, and Jared Polis, a Democrat from Colorado, said they are reintroducing the legislation because the Senate failed to act on it before the 114th Congress came to a close.

"Thanks to the wording in a more than 30-year-old law, the papers in your desk are better protected than the emails in your inbox," digital rights organization, Electronic Frontier Foundation said in a blog post.

If the legislation becomes law, government agencies will have to obtain a warrant (go.pcworld.com/emailwarrants) based on a showing of probable cause to compel service providers to disclose emails and other electronic communications of Americans, regardless of the age of the emails or the means of storage. In the original version of the legislation, government also has to notify the person whose account is disclosed, along with a copy of the search warrant and other information, within a stipulated period.

Privacy groups and tech companies backed the legislation when it was first introduced. But it failed to clear the Senate as it was bogged down with amendments such as the requirement of mandatory compliance by service providers without court oversight when law enforcement claimed an emergency as an exception for asking for user data. John Cornyn, a Republican senator from Texas, proposed an amendment (go.pcworld.com/s356) that would expand the information that the FBI can obtain with a National Security Letter without prior judicial oversight.

"Government access to communications without oversight of

warrants is a dangerous path for any country that supports democratic values," said Ed Black, CEO and President of the Computer & Communications Industry Association, in a statement.

"Rules on how the government can access electronic communications in criminal investigations have simply not kept up with advances in modern technology. Indeed, U.S. law still treats data stored in the cloud differently than data stored on a local computer," said Information Technology and Innovation Foundation vice president Daniel Castro in a statement.

Opposition to the bill came previously from a number of agencies including the Securities and Exchange Commission, which apparently uses administrative subpoenas on service providers to work around the handicap that people investigated often do not keep copies of incriminating mail after sending it or decline to share their content with the SEC.

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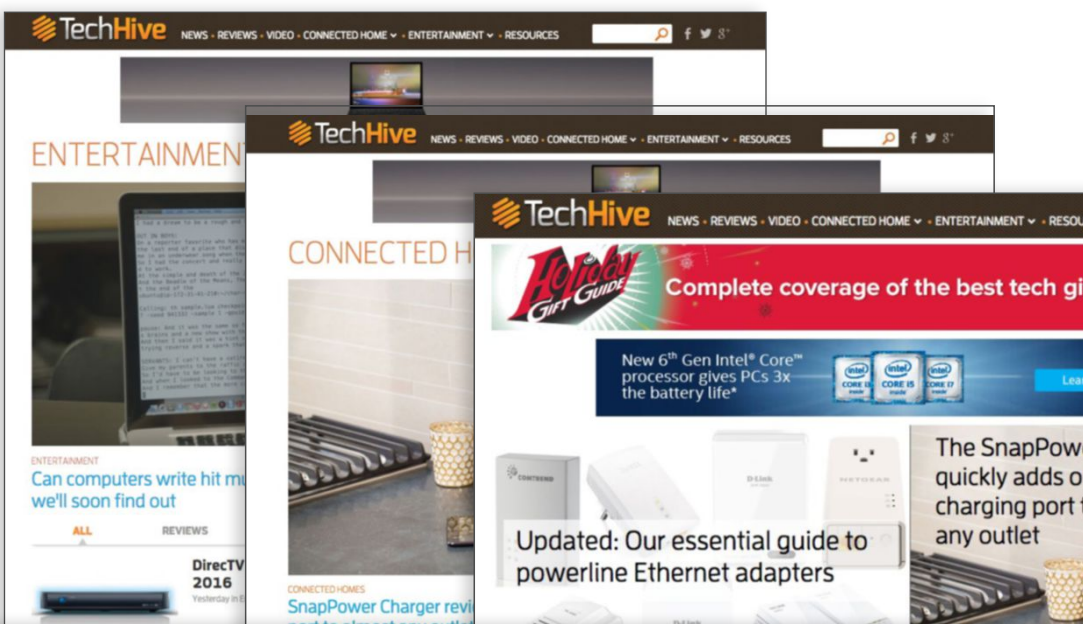

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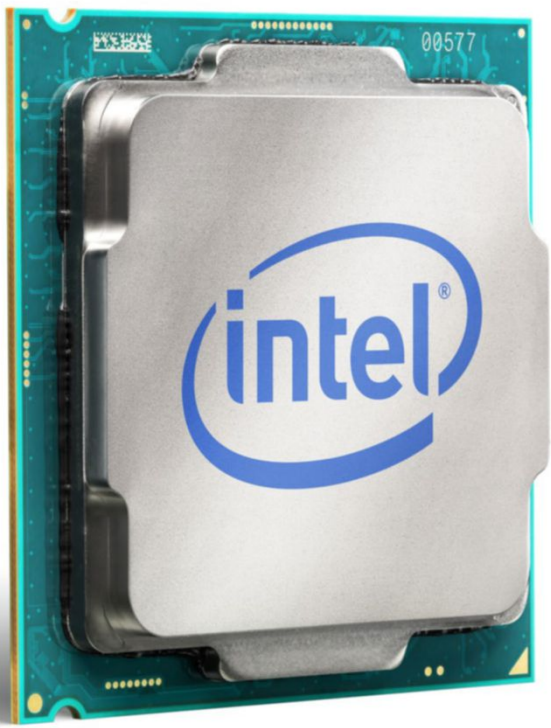


Official Intel 7th-gen Kaby Lake: One big change makes up for smaller ones

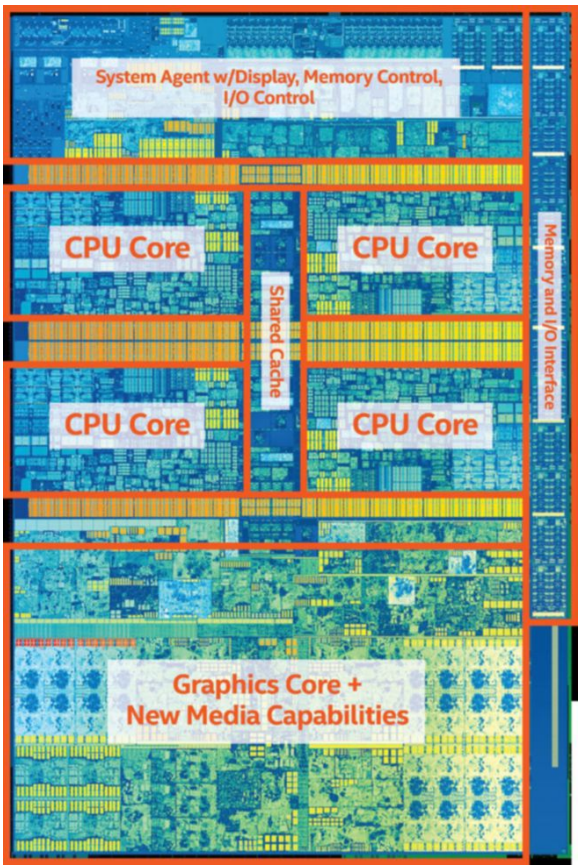
BY GORDON MAH UNG

INTEL'S RECENT ROLLOUT of the 7th-generation Kaby Lake CPU for desktops has met a dubious fanfare of leaked reviews that dismiss the new chip as one huge Core i-Yawn. Kaby Lake seems to offer barely any movement forward, and when it's overclocked, it apparently gets to nuclear-fusion levels of heat output.

But it's too early to write off Kaby Lake. There's a lot more to it that you still need to know.

What Kaby Lake brings to the desktop

Kaby Lake launched in August with dual-core versions for laptops that offered reasonable performance upticks (go.pcworld.com/kabylakerv). The highlight is its video engine, which can handle 10-bit content without breaking a sweat. Play a 10-bit color depth file on a Skylake laptop with integrated graphics, and you drop frames and destroy battery life. The same video on Kaby Lake hums along with far less impact. You can see this demonstrated right here (go.



Little-known fact: Kaby Lake gets the "7th-gen" name because of the improved graphics core and video engine, while the x86 cores are essentially unchanged.

Kaby Lake is the first K chip in several generations that seems able to hit 5GHz.

7th-Gen Intel Core Processor Quick Summary Chart

	CORES/ THREADS	BASE FREQ.	SCT	UNLOCK	INTEL GRAPHICS	DYNAMIC FREQ.	INTEL SMART CACHE	DDR4±/ DDR3L	TDP	INTEL VPRO
S-Series										
i7-7700K	4/8	4.2	4.5	√	HD 630	1150	8M	2400/1600	91W	
i5-7600K	4/4	3.8	4.2	√	HD 630	1150	6M	2400/1600	91W	
i7-7700t	4/8	3.6	4.2		HD 630	1150	8M	2400/1600	65W	√
i5-7600	4/4	3.5	4.1		HD 630	1150	6M	2400/1600	65W	√
i5-7500	4/4	3.4	3.8		HD 630	1100	6M	2400/1600	65W	√
i7-7700T	4/8	2.9	3.8		HD 630	1150	8M	2400/1600	35W	√
i5-7600T	4/4	2.8	3.7		HD 630	1100	6M	2400/1600	35W	√
i5-7500T	4/4	2.7	3.3		HD 630	1100	6M	2400/1600	35W	√
i5-7400	4/4	3.0	3.5		HD 630	1000	6M	2400/1600	65W	
i5-7400T	4/4	2.4	3.0		HD 630	1000	6M	2400/1600	35W	
i3-7350K	2/4	4.2	N/A	√	HD 630	1150	4M	2400/1600	60W	
i3-7320	2/4	4.1	N/A		HD 630	1150	4M	2400/1600	51W	
i3-7300	2/4	4.0	N/A		HD 630	1150	4M	2400/1600	51W	
i3-7100	2/4	3.9	N/A		HD 630	1100	3M	2400/1600	51W	
i3-7300T	2/4	3.5	N/A		HD 630	1100	3M	2400/1600	35W	
i3-7100T	2/4	3.4	N/A		HD 630	1100	3M	2400/1600	35W	

Intel's "S-series" compromises its desktop lineup of new Kaby Lake–based Core CPUs.

pcworld.com/kabydemvid). The updated graphics core with the latest content protection can now stream 4K from services such as Netflix.

On the desktop side, however, power users don't care about integrated graphics, focusing more on the lackluster x86 performance. To be fair, Intel set the expectation in August that Kaby Lake was basically Skylake on an improved process that squeezes out more megahertz.

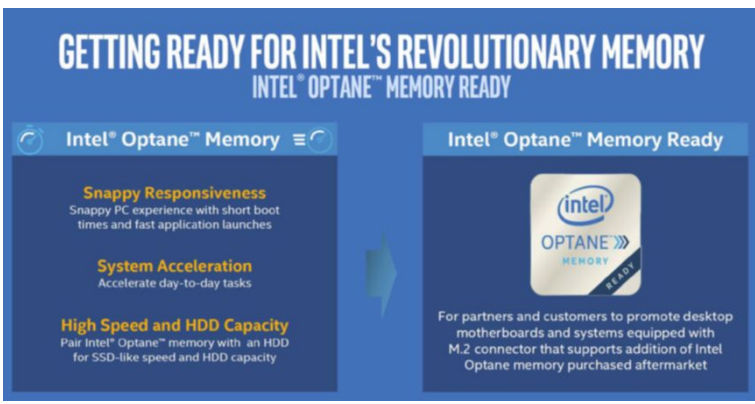
For example, the top-end Core i7-7700K has a base clock speed of 4.2GHz and a Turbo Boost clock speed of 4.5GHz, versus a Skylake Core i7-6700K's base clock of 4GHz and Turbo Boost of 4.2GHz.

The cache size, the core count, the memory controller and even the same LGA1151 socket are unchanged from the previous chip.

This is the real launch

Intel fleshes out the Kaby Lake lineup with a total of 42 CPUs: 17 ultra low-power chips for laptops, two quad-core Xeons, seven quad-core laptop CPUs, and 16 desktop CPUs.

Of particular interest in that desktop lineup to DIYers are the three unlocked K chips. The first two were expected: a quad-core with 4.2GHz Core i7-7700K with Hyper-Threading and a quad-core 3.8GHz Core i5-7600K without Hyper-Threading. The third is a surprise: the dual-core 4.2GHz Core i3-7350K. The CPU has Hyper-Threading but since it is a Core i3, does not have Turbo Boost enabled.



This isn't Intel's first "budget" overclocking chips though. The company introduced the dual-core Pentium G3258 Anniversary Edition in 2014 and as early as 2010, Intel sold the dual-core Core i5-655K.

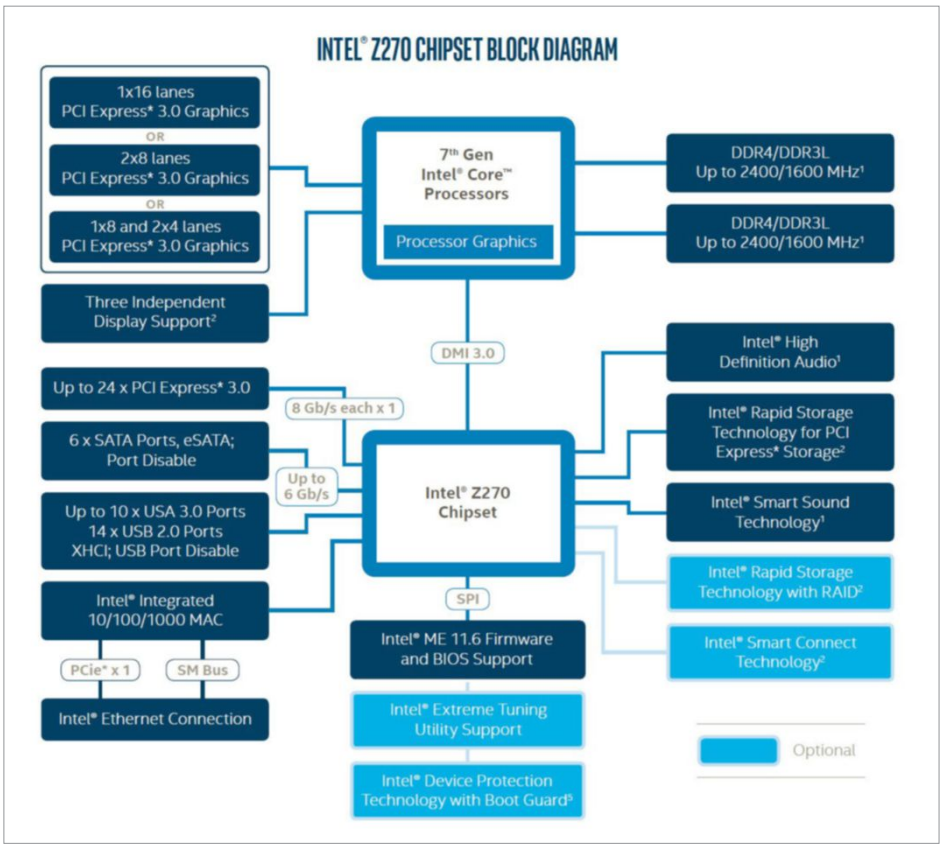
The new Z270 is "Optane-Ready"

With Kaby Lake for desktops, Intel is introducing new 200-series chipsets to replace the 100-series chipsets that were introduced with Skylake. Like Kaby Lake, it is an incremental update that disappoints a bit.

We expected the 200-series chipsets to feature native support for USB 3.1 10Gbps or maybe even Thunderbolt 3, but no. Instead, motherboard makers will have to add additional chips for those functions.

From what I can tell, there are three key changes to Z270. The first is an upgrade from the 20 lanes of PCIe Gen 3 in the Z170 to 24 lanes in the new performance Z270 chipset. The move will let motherboard makers integrate high-bandwidth connections such as M.2 or U.2 without having to share bandwidth between devices. Intel says it has

The Z270 is the first "Optane-ready" chipset from Intel. We just don't know what exactly that means yet.

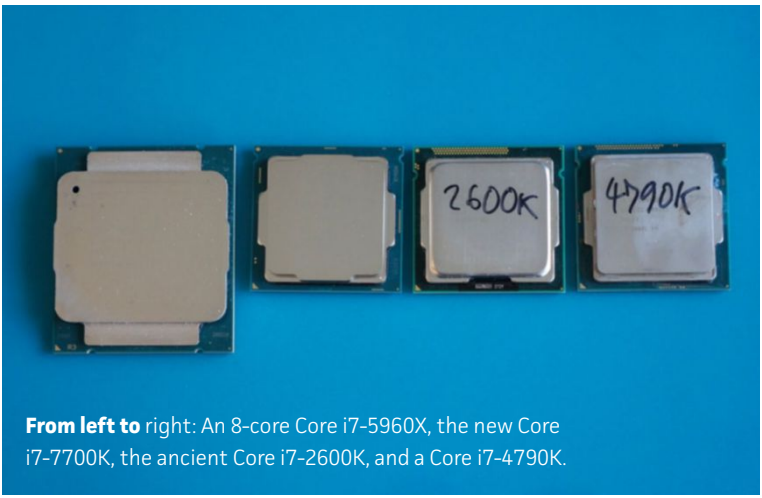


also improved overclocking capability.

The last upgrade is official "Optane-ready" support. What that means isn't exactly clear, but we do know Intel's Optane (a non-volatile memory that promises much higher performance than SSDs) will go into an M.2 slot on the board, where it can be used as a traditional storage device or as a way to accelerate system performance, much like what's done today with Intel's Smart Response Technology, which uses an SSD to cache performance from a traditional hard drive.

That doesn't mean Optane won't work in other systems using older chipsets, but Intel is likely to support it only for "system acceleration"

The Z170 chipset was a big step forward for mainstream motherboard chipsets, and the Z270 inches it a little bit farther forward.



From left to right: An 8-core Core i7-5960X, the new Core i7-7700K, the ancient Core i7-2600K, and a Core i7-4790K.

on Z270 initially.

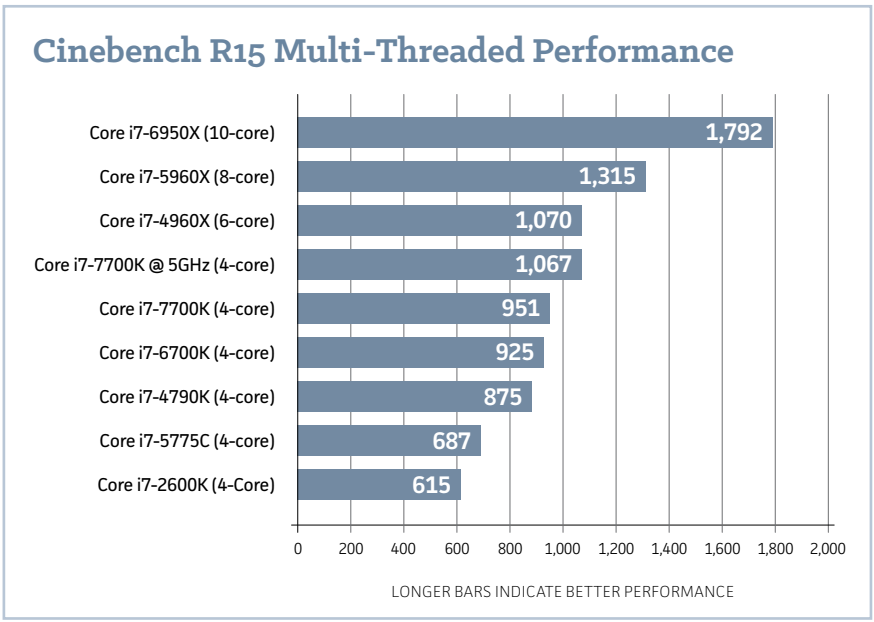
If none of these sound like much of an upgrade to your existing Z170 motherboard, the good news is you don't have to buy a Z270 motherboard. Kaby Lake drops into most LGA1151 Z170 motherboards and works just fine, as long as you're using an updated BIOS that supports the new CPU.

How we tested

For our performance testing, I focused on how Kaby Lake does against the CPU it replaces: I dropped the Core i7-7700K into the same Asus Z170 Deluxe motherboard that the Skylake chip was first tested with. The CPU was cooled with a Corsair H80i closed liquid cooler and outfitted with 16GB of Corsair DDR4/2133 RAM, a reference GeForce GTX 980 card, and a 256GB HyperX SSD. The OS was Windows 10 running the TH2 build.

Cinebench R15 multi-core performance

Our first test is Maxon's Cinebench R15. It's a benchmark based on Maxon's professional Cinema4D rendering engine and is a pure CPU test. We recorded scores from many of Intel's high-end quad-core mainstream chips and from chips with more cores, for context.



Cinebench R15 puts the new Core i7-7700K at the top of the heap for mainstream quad-core chips.

Among the quad-cores, the Core i7-7700K was the winner by the expected amount. The Kaby Lake CPU is roughly 4 to 5 percent higher in clock speed and roughly 4 to 5 percent faster in Cinebench. When you look back to the Core i7-2600K though, it's a huge 42-percent difference in performance. Stock clock performance between the Kaby Lake, Skylake, and Devil's Canyon, though, isn't exactly going to set the world on fire.

The Kaby Lake CPU is roughly 4 to 5 percent higher in clock speed and roughly 4 to 5 percent faster in Cinebench.

Cinebench R15 single-core performance

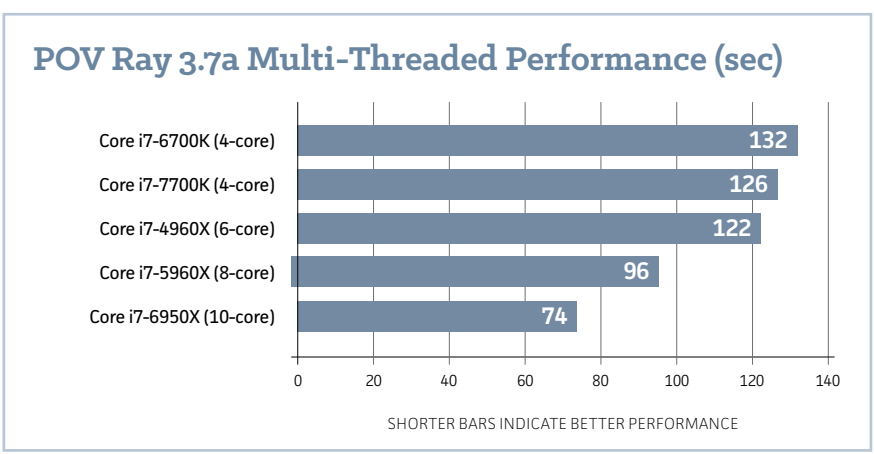
One error with focusing exclusively on multi-core performance is reality doesn't match that. The vast majority of applications are lucky

to exploit more than a single thread, instead favoring higher clock speeds and more efficient CPU cores. Once we set Cinebench R15 to run in single-threaded mode, the quad-cores with their higher clock speeds jump to the front of the line, with the Core i7-7700K now leading the pack. For most people, those who don't do 3D rendering or other heavily multi-threaded tasks, a quad-core with higher clock speeds is the right choice.

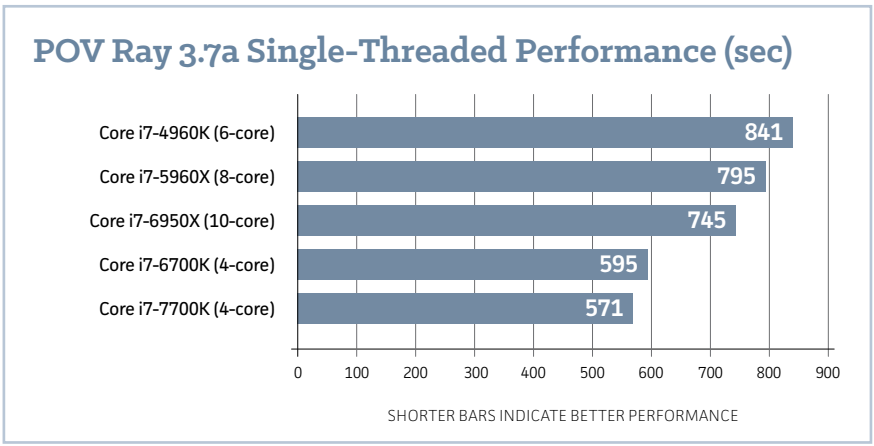
Other highlights from the results: There isn't a lot of daylight between the Core i7-7700K and the Core i7-6700K. Note, too, that our 10-core Broadwell-E Core i7-6950X was performed without Turbo Boost Max. Turbo Boost Max lets the CPU greatly increase the clock speed on a single core, bringing performance a lot closer to the quad-cores.

POV Ray performance

Another CPU-heavy test we use is POV Ray. It's a ray-tracing program that traces its roots back to the Amiga. Our benchmark set is a little smaller but no surprise, the Kaby Lake, with its 4- to 5-percent clock speed advantage, finishes the test about 4 to 5 percent faster,



POV Ray mostly matches our results from Cinebench R15. The Kaby Lake chip eases out in front of the Skylake chip, but it's not a game changer.



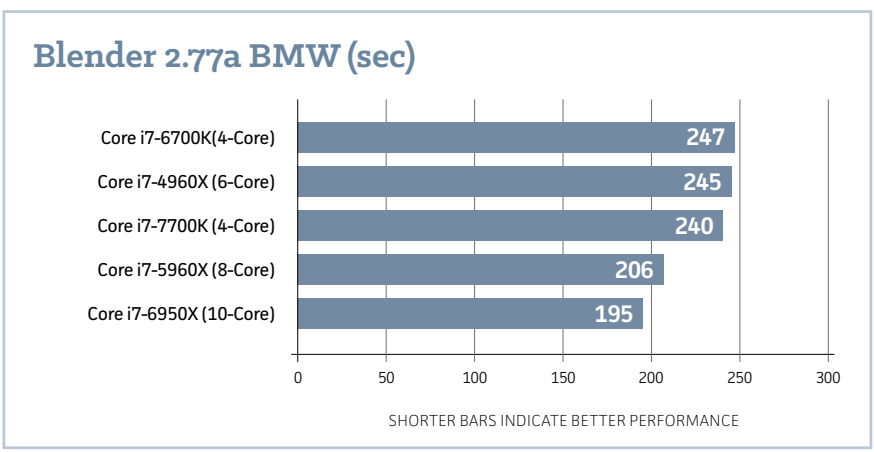
Just like with Cinebench, when you run on a single core, the higher frequency chips win.

putting the Core i7-7700K just barely behind a six-core Ivy Bridge-E Core i7-4960X.

As with Cinebench R15, we also run the test using a single-threaded workload. With lighter loads the CPUs can run at higher clock speeds and no surprise, the pair of quad-cores take the lead. Again, we saw maybe a 5 percent advantage for the Core i7-7700K over the Core i7-6700K.

Blender performance

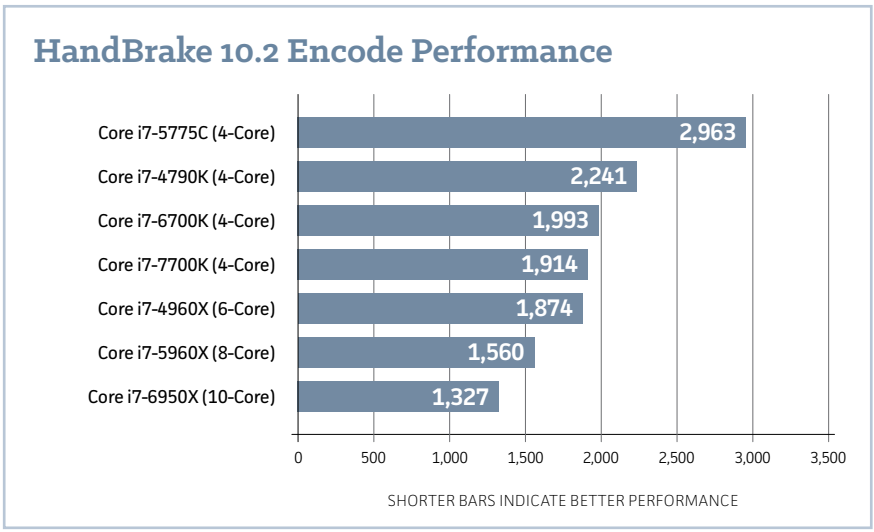
Our final rendering test uses Blender 2.77a and Mike Pan's BMW workfile to measure how fast the various CPUs can render a single frame using the free and popular Blender app. The Core i7-7700K again pulls ahead of the Core i7-6700K by a small percentage, well within what we expected for its clock-speed advantage. And yes, that six-core Ivy Bridge-E Core i7-4960X is really starting to look moldy here. One thing I'd like to point out about Blender is it doesn't show the scaling with thread count as much as Cinebench R15. While the 10-core Core i7-6950X is the winner here, it's not as impressive as I would have expected for a $1,723 CPU.



Blender 2.77a is a free render application popular with indie filmmakers.

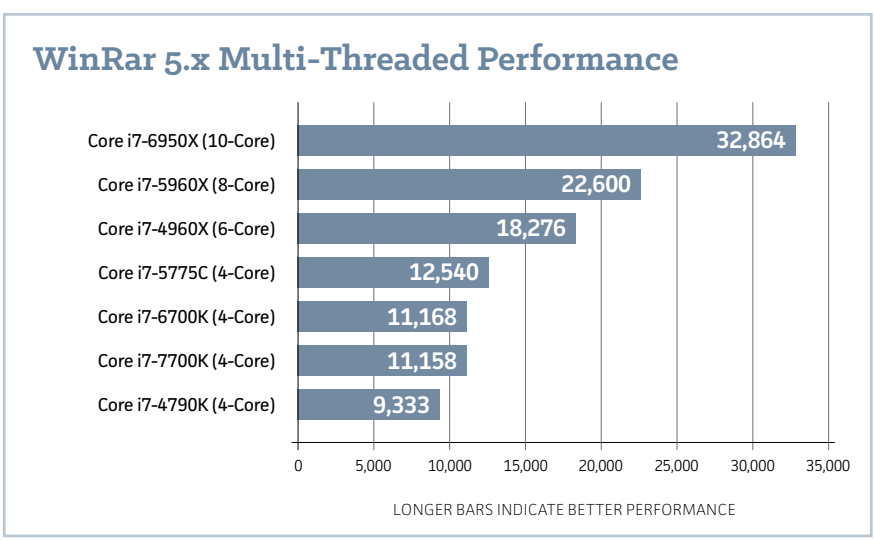
HandBrake 10.2 performance

Turning to video encoding, we used the popular and free HandBrake 10.2 encode to convert a 30GB MKV file using the Android tablet preset. The Core i7-7700K again comes in slightly ahead of the Core i7-6700K. There's also a pretty healthy distance between the Kaby Lake chip and the still-excellent Devil's Canyon chip. The older Ivy Bridge-E Core i7-4960X disappoints yet again, especially considering that it has six cores yet is basically tied with the quad-core Kaby Lake chip.



WinRAR Performance

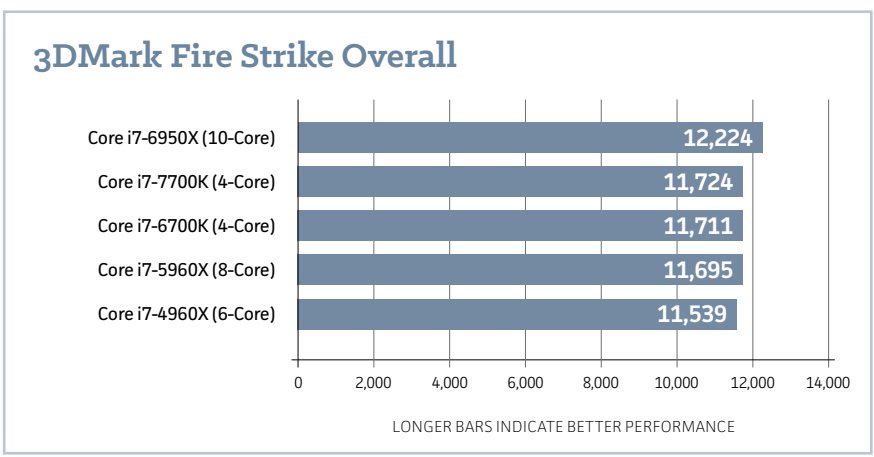
You should have the idea by now that the 4- to 5-percent clock increase from Skylake to Kaby Lake pretty much yields a 4- to 5-percent increase in performance across the board, so our last CPU-



only test is WinRAR. Unlike the other tests, where we ran the exact same app our machines, these results include both 5.21 and 5.31 results (for the Core i7-5775C and Core i7-4790K). The only difference between 5.21 and 5.31 appears to be bug fixes that don't impact the built-in benchmark. Unlike Cinebench, POV Ray, or Blender, WinRAR is a little more sensitive to memory bandwidth.

Both the Skylake and Kaby Lake CPUs are pretty much dead even here. We also see the Devil's Canyon chip is more than 15 percent slower than the Skylake and Kaby Lake chips. The surprise, for the quad-core CPUs, is the Core i7-5775C Broadwell CPU. Despite its lower clock speed of 3.3GHz to 3.7GHz, it's leading the pack of quad-core chips.

That isn't some magic of the Broadwell micro-architecture though. It's likely due to the large amount of embedded DRAM cache Intel put into the CPU. Read about this chip here (go.pcworld.com/i75775c).

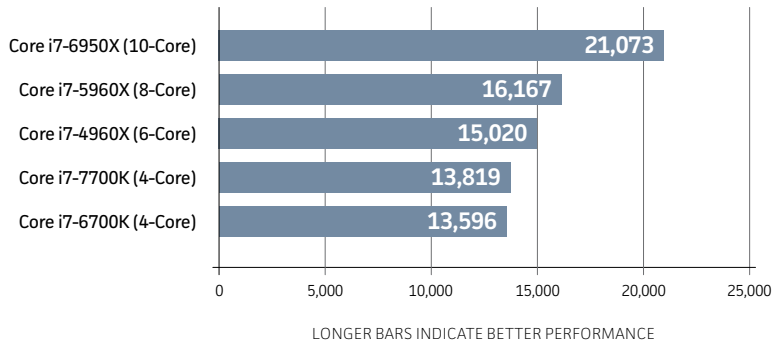


The CPU still plays very little role in most graphics chores. Duh.

3DMark performance

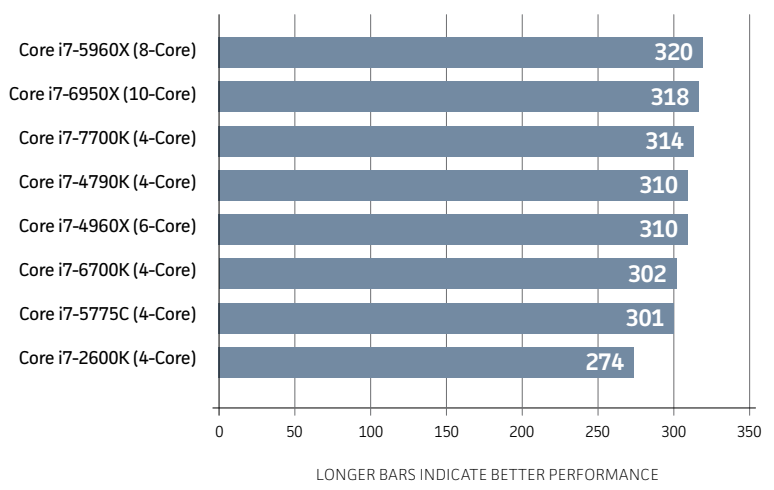
Gaming in this day and age is still 90 percent about the GPU, which is why I ran 3DMark Fire Strike. All of the machines used reference GeForce GTX 980 cards and the same driver. As you can see, it's mostly

3DMark Fire Strike Physics



When it comes to physics there is an advantage, but most gaming is still primarily a graphics task.

Tomb Raider Normal 19x10 (fps)



In an actual game, most of your dividends still come from the graphics chip once you have a decently powered quad-core chip.

a tie. The 10-core Broadwell-E gets a small advantage because 3DMark factors the physics performance into the overall score, but this is mostly a tie.

Because this is a CPU review, I also decided to break out the physics performance, which favors core count over clock speed. No surprise, the 10-core comes out on top. If you're looking at these two charts and trying to decide how they should influence your buying or building decision, I'd say the graphics score is far more important so long as you have a decently powered quad-core chip.

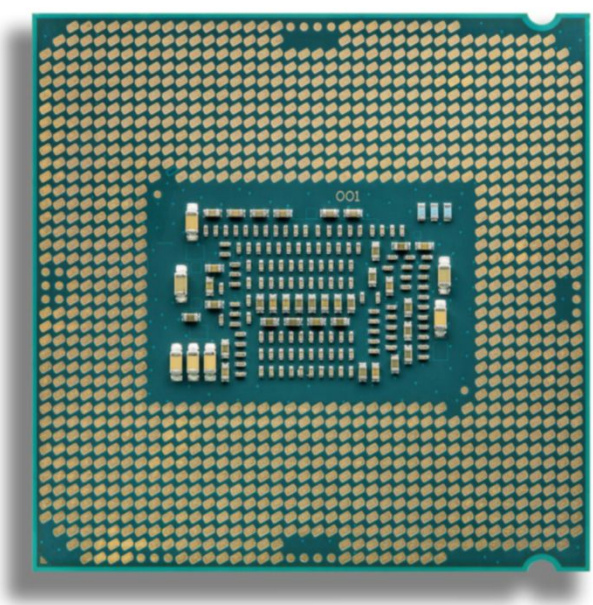
Tomb Raider performance

I also fired up the slightly older Tomb Raid and ran the built-in benchmark at 1080p resolution at the Normal quality setting. I chose Normal rather than Ultra to try to make this more about the CPU than the GPU.

The Core i7-7700K again leads the pack for quad-cores but it's really no big deal. Again, yawn.

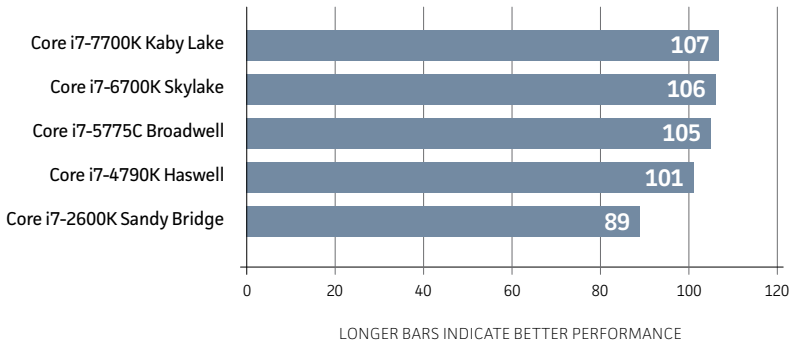
The IPCs have it

CPU nerds like to talk about IPC, or instructions per cycle of a CPU. It's one way to gauge efficiency at a given clock speed. I took the performance of each CPU running the Cine-Bench R15 test in single-threaded mode with Turbo Boost switched off on all of the CPUs. As I said with the Skylake Core i7-6700K review, it's a pretty sobering wake-up call to see just how slowly IPC is inching along in modern CPUs.



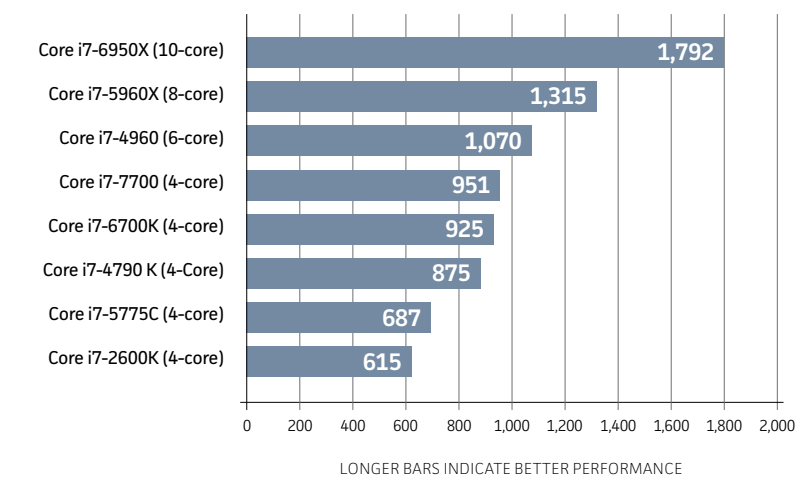
The back of a Kaby Lake CPU.

Cinebench R15 Single-threaded Performance Locked at 2.5Ghz



With all five CPUs locked at 2.5GHz, you can see that the efficiency of each has only slowly increased.

Cinebench R15 Multi-threaded Performance



Clock speeds, core count, and process keeps performance moving along.

The good news for modern processors is IPC isn't the only place you can pick up performance. Clock speed, core count, and ability to hold Turbo Boost speeds longer (thanks to improved manufacturing) have all added up to better performance. Here's that reminder seen in the first chart we ran from Cinebench R15, when each CPU is allowed to run unfettered rather than locked down to a fixed frequency.

Overclocking performance

Many of the early unsanctioned reviews of Kaby Lake gave it a black mark for generating excessive heat when overclocked.

I have always been reluctant to offer judgment about the overall overclocking performance of an entire CPU series when working with a sample of one. Combine that with new motherboards, new BIOSs and the dizzying amount of mistakes a reviewer can make, and you can see why I think it's unfair to decide on an entire line based on one CPU and early motherboards.

Still, in an attempt to get a feel for how Kaby Lake will overclock for most, I spoke to two PC OEMs and a motherboard maker who have been trying to overclock

Asus said its new Z270 motherboards should be able to overclock Intel's new with an 80 percent success rate.

the CPU for far longer and with far more samples.

The Kaby Lake results they've seen were quite good. Many of their chips hit 5GHz or got very close.

Motherboard maker Asus, in fact, will feature overclocking profiles that should make overclocking a lot simpler.

"Through rigorous testing, ASUS engineers have fine-tuned a profile that allows Kaby Lake CPUs to overclock to 5GHz with an 80 percent success rate," the company said.

The Kaby Lake results they've seen were quite good. Many of their chips hit 5GHz or got very close.

This is actually a great sign for practical overclockers because 5GHz overclocks haven't been seen since the days of the Core i5-2500K and Core i7-2600K. Both of which could seemingly run at 4.5GHz on air or 5GHz with liquid cooling.

You can't say the same about the CPUs that followed Sandy Bridge. Ivy Bridge and Haswell both hit walls at 4.5GHz for most people. Devil's Canyon was supposed to break the 4.5GHz barrier but all we got were chips that could get closer to 4.5GHz but not surpass it. Broadwell didn't count (it didn't ship in great volume), and Skylake also hit that same invisible barrier at 4.5GHz.

With its massaged 14nm process, Kaby Lake finally seems to break that magical barrier. To prove it, I had Digital Storm and Falcon Northwest send two production PCs that could break the 4.5GHz barrier. Both did. The Digital Storm system, for example, was able to withstand almost four hours of continuous HandBrake encodes with all cores locked at 5GHz without issue. The Falcon Northwest machine could hit 5GHz in a small-form-factor box.

Running at 5GHz, the Kaby Lake will match a six-core Ivy Bridge-E in performance. In single-threaded applications at 5GHz, the results are even more impressive.

Does this mean your chip will hit 5GHz? No. Remember, it's always been a lottery system with overclocking results, but the word from experienced boutique PC builders and Asus is far more promising than it's been in a long time.

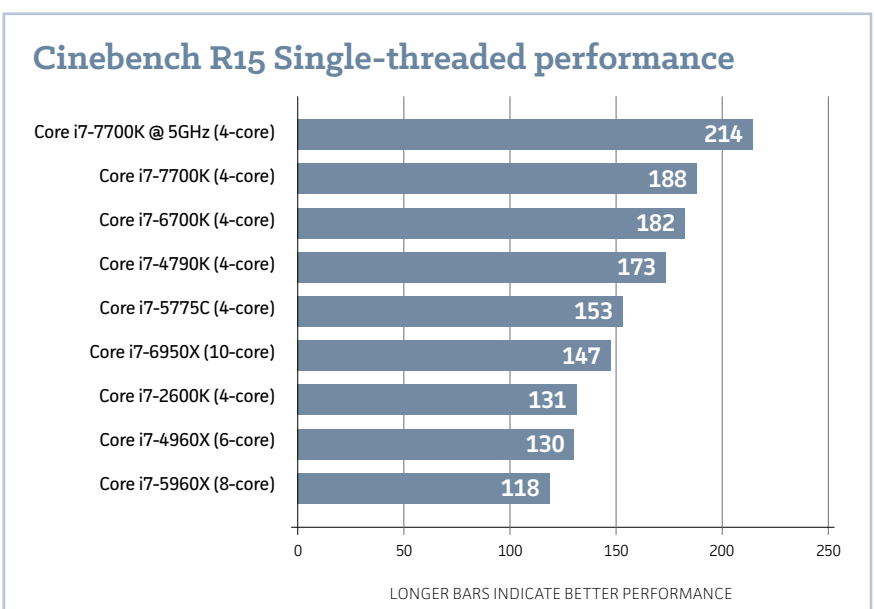
As much as everyone wants to be a hater, it's looking very much like Kaby Lake, for those who want to go there, can break 4.5GHz at last.

Umm, how much again?

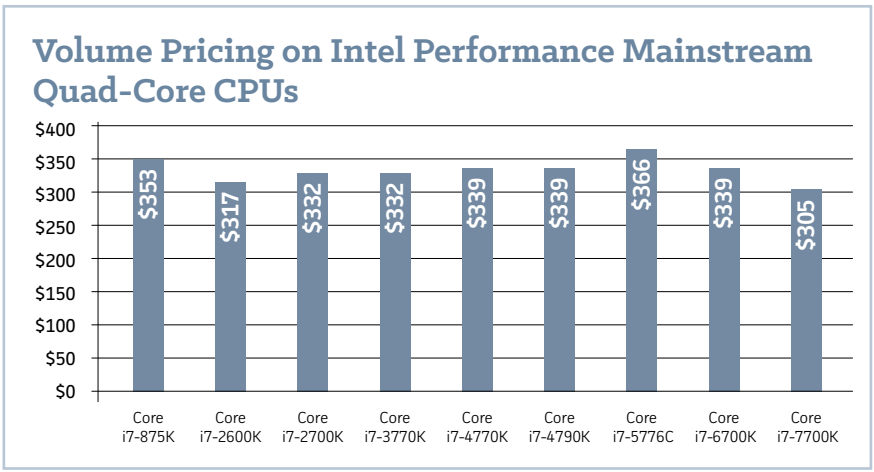
So we have an official, sanctioned view of just how a desktop Kaby Lake performs. Now, what everyone wants to know is how much. There is, again, more disappointment.

The initial prices the press was given for Kaby Lake CPUs would have made the Core i7-7700K, at $305, the cheapest Core i7 "K" CPU the company has ever produced. It was low enough that I mapped out the price of the chip in a chart and was prepared to write that the CPU price war had already begun with AMD over its upcoming Ryzen.

Alas, it was all wrong. Intel updated its price sheets, increasing the price to $339. That's the same price as the Haswell, Devil's Canyon, and Skylake Core i7 chips launched at.



A Kaby Lake running at 5GHz in single-threaded tasks will be tough to beat.



The initial price of the Core i7-7700K we were given would have been the cheapest Core i7 "K" CPU in history. Unfortunately, that turned out to be wrong.

In defense of Intel, every new chip in the price list went up by $34 to $63. Even laptop CPUs, where Intel essentially has no competition from AMD today, increased. So maybe this was truly just an across-the-Excel formula error and not a reason that's spelled Ryzen. Clearly, though, the price war with AMD isn't kicking off with Kaby Lake.

Conclusion

So let's sum it up. In laptops, the performance bump is very decent, with perhaps 20 percent or more going from just Broadwell to Kaby Lake.

Desktops aren't constrained by thermals and battery life the way laptops are, so the performance difference between the generations is far less. The one really big difference between previous chips is the greatly improved video engine. To performance-oriented desktop users, though, integrated graphics—outside of NUC-style mini-PCs—is unimportant.

The price, though equal to Skylake, is a little disappointing for those who expected it to be cheaper, but it's not like you're paying more for

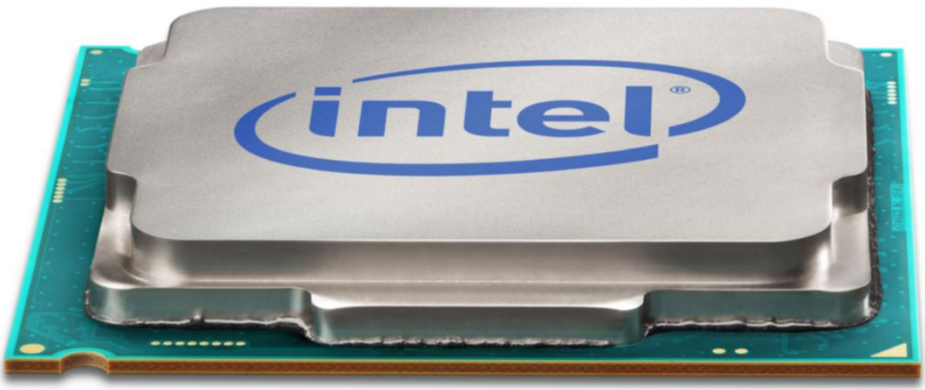
less performance. Instead, you're paying the same price to get a little better performance.

Kaby Lake is better and faster, but despite the greater overclocking potential, you can see why, for most DIYers, it's a little bit of a yawn. Still, some builders should consider it, and I break down the decision tree CPU by CPU right here.

If I had a Core i7-6700K system: I wouldn't upgrade to Kaby Lake, and I don't think Intel expects you to unless you want to help prop up the company's bottom line. There's just absolutely nothing compelling that would warrant it on a discrete graphics system right now. If Intel's Optane emerges as a game changer, then you'd consider a move.

If I were going to build a new Core i7-6700K system: I wouldn't. Instead, I'd build one using the new Core 7-7700K. Even if you don't intend to overclock it at first, the stock clock is already higher, and

Kaby Lake is a drop-in replacement for Skylake. I'm just not sure anyone should or would do that.



prices will be the same once initial demand settles down. The simple math is Kaby Lake is better, so there's no reason to buy Skylake today.

If I had a Core i7-4770K or Core i7-4790K system: I probably wouldn't upgrade. The Core i7-4770K is still quite a powerful and useful CPU. The only reason would be the need for more M.2 or U.2 storage options, or if you want to be ready for Optane.

If I had a Core i7-4960X or Core i7-3960X system: The results are pretty clear for these elderly CPUs: Even a once mighty six-core CPU can now be matched by Intel's new Core i7-7700K chip in some workloads. However, if you were the kind of person who bought a six-core Sandy Bridge-E or Ivy Bridge-E, you care about core count for a reason. It makes far more sense to buy into Intel's Broadwell-E platform to run a six-core or eight-core CPU. Or just wait to see if AMD's Ryzen can give you the core counts and performance you need.

If I had a Core i7-3770K or Core i7-2600K: Look, there's nothing wrong with the classic Core i7-3770K or Core i7-2600K in actual CPU performance. The problem is your chipset. The Z77 chipset only has two SATA 6Gbps ports, and good luck trying to run a modern M.2 NVMe drive in them. These platforms are about as creaky as a Pontiac Grand Am with 275,000 miles on the odometer and a leaky transmission. It's basically time to upgrade, and Kaby Lake would be fine for both.

If I had a Core i5: You can get by with a quad-core without Hyper-

Threading, but anecdotal reports from many say the days of a quad-core only CPU are drawing to a close. And if you have to upgrade your Sandy Bridge or Ivy Bridge Core i5 chip (or even Haswell or Skylake), it probably makes sense to upgrade all the way to a new Kaby Lake CPU.

If I had an AMD FX-9590: Well yes, an upgrade to Kaby Lake for your AMD "eight-core" would be very nice. But let's face it, there's a reason you're rolling one of AMD's top CPUs—you're an AMD fan. Just wait to see if AMD's Ryzen materializes and offers the price-to-performance ratio people are hoping for so you can continue to fly the white, black, and green flag. If Ryzen does falter out of the gate (unlikely), then, yes, a shiny Kaby Lake might be in your future.

Gigabyte PC (GB-GZ1DTi7-1070) : A powerhouse PC diminished by noisy fans

BY ALAINA YEE

APPARENTLY, A BRIX can change quite a bit in appearance and still remain a Brix. When Gigabyte first launched the line, it was a reference to lookalike versions of Intel's Next-Unit-of-Computing (NUC) systems: bare-bones machines in the form of 4x4-inch blocks. Then it expanded to encompass teeny-tiny tower versions of said mini-PCs (like the Brix Gaming UHD go.pcworld.com/brixuhd).

Now the term includes the Gigabyte PC, a 10-liter small-form-factor PC. This "Gaming GT" line of Brix systems sports full desktop-sized CPUs and GPUs, and sells as complete machines with Windows 10 Home installed.

This addition to the Brix

lineup is a little surprising, given the history of itty-bitty systems that you had to kit out yourself. But more startling (and disappointing) is the mixed experience of using the Gigabyte PC: You get great performance, but with the cost of a lot of fan noise.

Chassis and ports

Given the history of Brix machines that blasted so shrilly you could hear them from clear across a house (go.pcworld.com/bxa85557), you could argue that the Gigabyte PC is indeed a chip off the old block. Its level of noise varies between loud and shrill during CPU loads, and just loud during GPU loads.

But unlike its smaller siblings, you can't dismiss the Gigabyte PC as easily to a sound-dampening cubby—this machine is meant to be seen. Besides the neon-green mesh and programmable LEDs, the Gigabyte PC features an attention-grabbing venting system: Once internal temperatures reach a certain point, the two flaps up top should

Gigabyte PC (GB-GZ1DTi7-1070-NK-GW)

AT A GLANCE

Sizing up from a typical Brix size means more power, and the Gigabyte PC delivers that in spades. Its only weakness is its loud cooling—if you hate fan noise, its performance doesn't feel quite as sweet.

PROS

- Excellent performance
- Compact size
- Sleek design with clean cable routing

CONS

- Fan noise is quite loud and sometimes shrill

$1,700

★★★★½

automatically lift open.

Now, our review unit didn't actually do this automatically, not even when I hammered on it with Prime95 and Furmark. My guess is that because our unit came to us before CES, the utility or BIOS setting that kicks the doors open wasn't ready yet. But when I gently experimented with manually opening the flaps to see how it affected fan noise (spoiler: it didn't), the look turned heads, for sure. More than one person in our office stopped and inspected the Gigabyte PC as I ran benchmarks.

Port placement also is uniquely tailored for a life of sitting out in the open. You'll only see a handful of inputs along one of the narrow sides of the machine: separate headphone and microphone jacks, and two USB 3.0 Type-A ports. It's equivalent to what you'd find on the front or top of a standard desktop case.

The bulk of the ports live underneath a panel on one of the case's broad sides, as well as along the bottom of the machine. Under the side panel are an HDMI port, three USB 3.0 Type-A ports, a Thunderbolt 3/USB 3.1 Type-C port, and a DC-in power jack, while the bottom section holds a power connector, audio jacks, a gigabit ethernet jack, and the included GTX 1070's video connectors (three

DisplayPort, and one each DVI-A, DVI-D, and HDMI). All wires feed out from the bottom of the case—an opening exists on each narrow side for routing. The design keeps this small system from becoming dominated by plugs and wires.

Of course, looks might not be enough to entice someone to keep a machine on a desk. But I'd still be hesitant to hide this machine away, even if I hated its appearance. Opening those vents failed to really affect fan noise and internal temperatures, and tucking it somewhere with limited air flow might be a bad idea. It's pretty densely packed inside.

Specs and pricing

Our configuration came fully stuffed with high-end hardware: an overclockable Intel Core i7-6700K Skylake processor, an ever-so-slightly

overclocked desktop Nvidia GTX 1070 graphics card, 16GB of DDR4/2133 RAM, a 256GB Transcend SATA 6Gbps SSD, and a 1TB hard-disk drive from HGST. Also included is an Intel Wireless-AC 3165NGW dual-band card.

Gigabyte quoted us a price of roughly $1,700 at press time for our review unit, but that may not be the final amount, as the official version of this Gigabyte PC (the GB-GZ1DTi7-1070-NK-GW) comes with a 240GB SSD. Regardless, it'll cost more than a comparable DIY small-form factor build, which would run about $1,485 to $1,510.

A quick glance at Newegg shows current prices of about $330 for the processor, $430 for a similar graphics card, $100 for RAM, $100 for the SSD, $60 for the hard disk drive, $150 for a motherboard, $120 for a gold-rated modular 600W power supply, $75 to $100 for a mini-ITX case, and $120 for a retail copy of Windows 10 Home. You're definitely paying a little bit of a premium.

Performance

Of course, you can't exactly replicate the ultra-compact nature of this machine with standard off-the-shelf parts. And if money doesn't matter

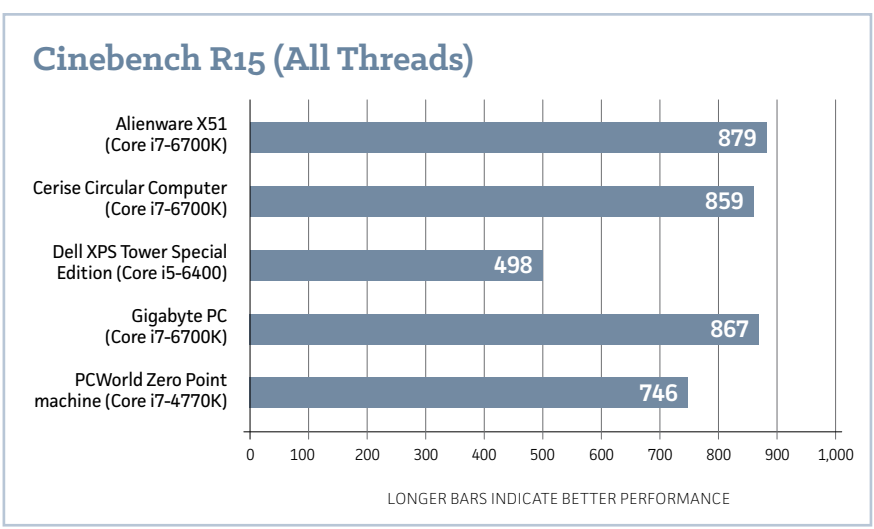
overly much to you, you do get all the performance you'd expect out of the Gigabyte PC's included hardware, even despite its cramped quarters.

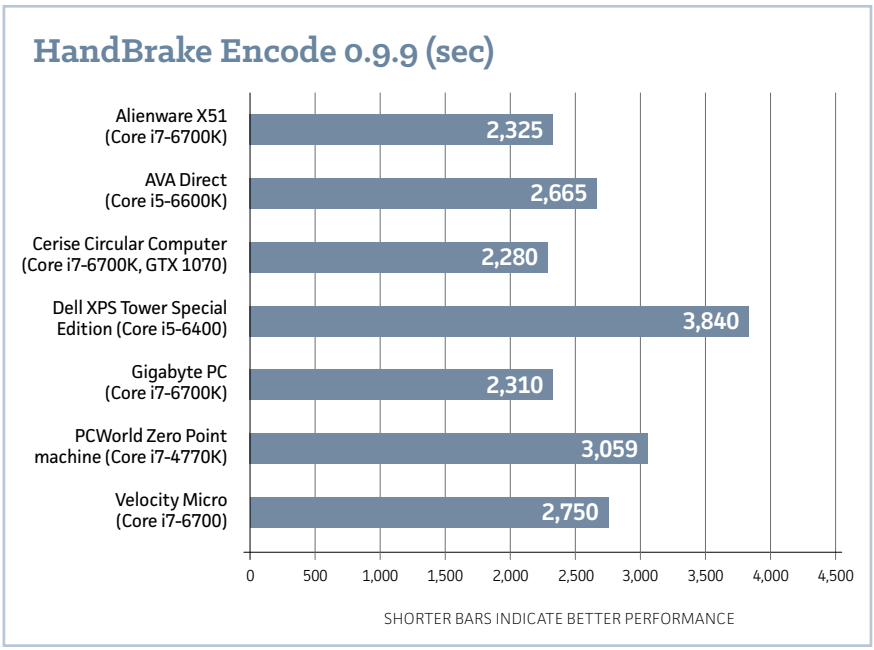
For our tests, we left the CPU at its stock speed of 4GHz, as we don't expect the chip to overclock much. Space is tight in this machine, and CPU temps rose to about 100°C during stress testing. It stayed stable there at both the 60-minute and 90-minute marks of running Prime95, but not much of a margin exists for pushing up the clock speed. The GTX 1070 graphics card also ran at its default settings, which were a slightly overclocked 1,595MHz base speed and 1,785MHz boost speed.

Cinebench R15

The start of our benchmark gauntlet was Maxon's Cinebench R15, which leans heavily on the CPU for a few minutes while the test renders a 3D scene. When we run this test, we don't expect to see much of a difference between similarly configured PCs. However, if the results do look unusual, it can indicate either an unexpected design philosophy or actual issues.

In the case of the Gigabyte PC, its score closely hews to those of other small form factor PCs with the same processor. It technically





outdoes the soon-to-be-reviewed Cerise PC by a tiny margin, but stays just behind the Alienware X51. The X51's performance is noteworthy because of how quietly the machine runs—at a soft hum, versus the Gigabyte PC's audible blast of fans.

HandBrake 0.9.9

While Cinebench shines a light on how a machine handles short bursts of CPU activity, our HandBrake benchmark reveals how a system's processor handles extended loads. This real-world encoding test involves taking a 30GB MKV file and using HandBrake's Android Tablet preset to crunch it down into a much-smaller MP4. It hammers hard on a CPU and scales well with core count.

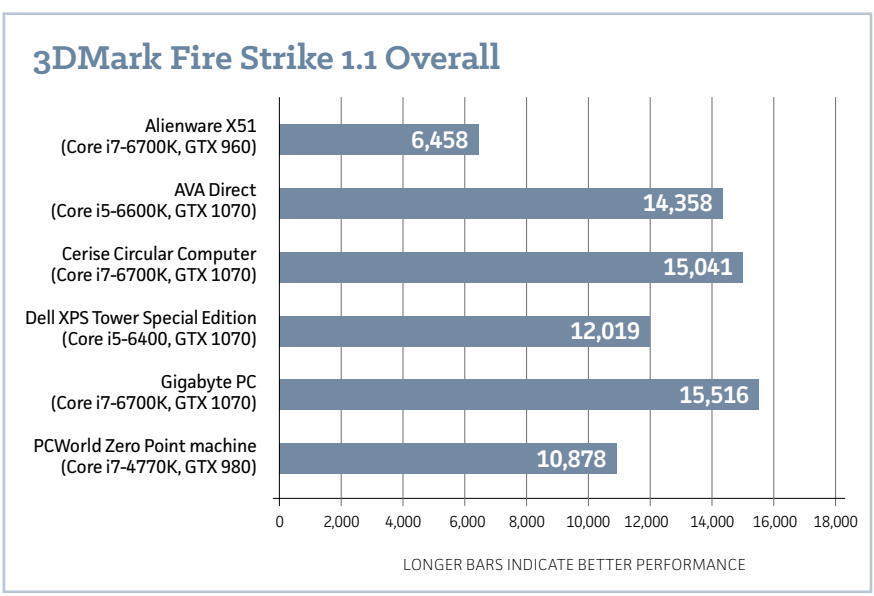
The Gigabyte's Core i7-6700K should chew through its task in under 40 minutes, which it does. Overall, the Gigabyte PC, Alienware X51, and the Cerise all manage to finish the task in about the same amount of time. The

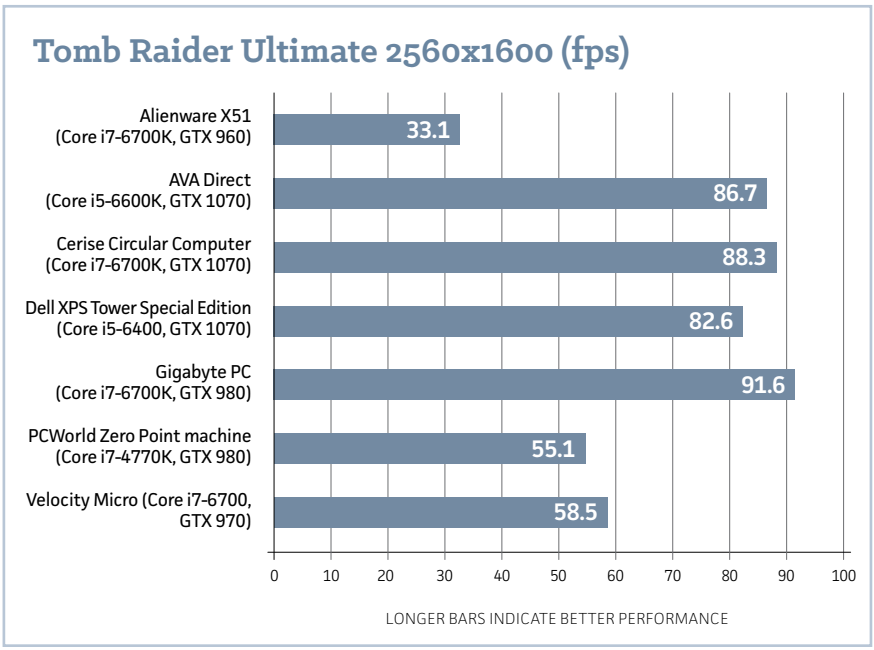
Alienware X51, though, still stays quieter throughout, and that difference makes the Gigabyte PC's performance a tiny bit disappointing.

3DMark Fire Strike

Why Fire Strike, which is designed for systems with less powerful graphics cards, and not Fire Strike Extreme or even Fire Strike Ultra? Well, I wanted to include our *PCWorld* zero-point machine (and its GTX 980) in our chart to give broader context to the Gigabyte PC's performance, but it was temporarily out of commission and unable to cough up a Fire Strike Ultra result. So, I had to fall back on its existing Fire Strike score.

Though this synthetic test went a little easier on the Gigabyte PC than its Extreme or Ultra variants, you can still see that this PC's GTX 1070 keeps even pace with those in the Cerise and Dell's XPS Tower. That card also handily lays a beat down on the GTX 980 in our zero-point machine—solid proof of that monumental leap from Maxwell to Pascal. As for the Alienware X51, it might be quieter, but its more modest last-gen GTX 960 relegates it to the bottom of the heap in this benchmark.





Tomb Raider

Moving on to a real game, we pulled up the creaky but still reliable *Tomb Raider*. At four years old, it should be an easy task for the systems running Pascal graphics cards—and it is, though the Gigabyte PC still blasts its GTX 1070's fans.

In fact, that's probably the most interesting part about all of these results. The Gigabyte PC edges out its fellow GTX 1070 contemporaries by a small margin—some more than others, because games can sometimes rely on the CPU, too. But the noise! You'd think that with an older game, Gigabyte's machine wouldn't work its fans so hard, but that's not the case. Though the sound isn't shrill, like when the CPU's under load, it's still loud.

That said, getting over 90 fps at 2560x1600 is pretty sweet. That's Pascal for you.

Rise of the Tomb Raider

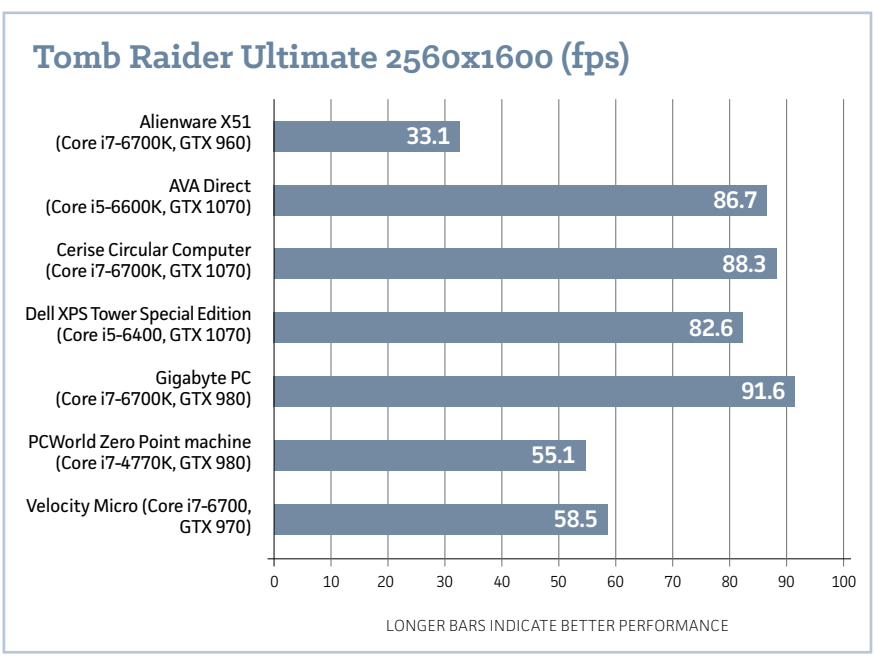
Moving on to a newer game shows more of the GTX 1070's limits. The sequel to *Tomb Raider* is just over a year old and features some incredibly pretty graphics. Accordingly, playing it at 2560x1600 is much more punishing.

Still, you get frame rates above that desired threshold of 60 fps. In fact, the Gigabyte PC even manages to lead the pack. Those noisy fans do enable solid performance, because Gigabyte's gigantic Brix machine is able to edge out a micro-ATX build with more airflow (the Avant Tower).

Conclusion

The Gigabyte PC is a powerhouse. The problem is that despite performing so well, it's hard to ignore how noisy it is.

Granted, what's a headache-inducing din for one person can be a bearable murmur for someone else. But while this oversized Brix isn't



nearly as shrill as some of its tinier (and older) siblings, it's still clearly audible. Every single coworker that stopped to examine it would comment about its design, compliment its color scheme, prod at its flaps…and then remark on the roar of its fans.

It's a real shame, because the Gigabyte PC seemed poised to fill the void of Alienware's discontinued X51: a ready-to-go gaming PC that was sleek, compact, quiet, relatively affordable, and bursting with performance. Instead, it's best suited for people who don't mind turning up the volume on their speakers or headsets.

Lenovo Yoga 910: A host of excellent upgrades make it a winner

BY JOSH NOREM

LENOVO'S YOGA 910 is the Yoga 900 (go.pcworld.com/yoga900r) convertible, upgraded—and the result is an incredibly well-rounded ultrabook that addresses all of our complaints from the previous version. That's a rarity in the tech world.

Not only is the new version more powerful than the previous model, it also now has a much longer-lasting battery, a faster SSD, and a gorgeous edge-to-edge display. It's not perfect, of course, but it's darn close.

Plenty of Upgrades

The already-capable Yoga 900 got a boost across the board to transform it into the Yoga 910. First and foremost, Lenovo has upgraded the CPU from sixth-generation Intel Skylake chips to the new and improved seventh-generation Kaby Lake (go.pcworld.com/7thkaby) platform, which offers a modest performance boost. The Yoga 910 has just one option for the CPU, the Intel Core i7-7500U, which is a dual-core part with hyper-threading, a base clock of 2.7GHz, and a boost clock of 3.5GHz. It's paired with 8GB of DDR4/2133 memory, with the option of 16GB if you buy the most expensive model ($1,649). Yes, you read that right: DDR4 RAM in an ultra-thin laptop. Most Ultrabooks eschew the faster and denser DDR4 for power-sipping LPDDR3, but Lenovo decided to go for the memory-bandwidth brass ring instead.

By the way, there doesn't seem to be an easy way to access this laptop's components, so forget about a DIY upgrade.

The Yoga 900's SATA SSD has been replaced with a much speedier PCIe NVMe drive, which addresses one of our gripes from before. In

Lenovo Yoga 910

PROS

- Excellent overall performance
- Superb battery life
- Gorgeous display

CONS

- Awkward webcam placement
- Limited port selection

$1,330

★★★★½

our tests, this Samsung PM951 M.2 drive delivered 1.2GBps sequential read speeds, with oddly low sequential read speeds in the neighborhood of 300MBps (the drive is rated at 560MBps).

Still, it's a huge upgrade from the SATA drive used previously. Both the base model we're testing and the one above it sport the 256GB drive, while the top-end config features a 1TB SSD.

Another big, welcome change is the practically invisible 6mm bezel around the sides and top. It frames a sharp 13.9-inch 1920x1080 IPS touchscreen that features accurate and crisp colors. (If you need a higher-resolution screen, you can upgrade from this base model to a more expensive version with a 4K UHD panel.)

This gorgeous display is glossy, however, so daytime reflections can be problematic. Its bottom bezel is absolutely massive, too: At over an inch thick, it looks out of place. Worse, because it's the only open space on the display, Lenovo put the webcam there as well, making for awkward Skype sessions. (Yes, this is exactly the same design used by the Dell XPS and its Infinity Edge display. go.pcworld.com/infinedge) I don't use a webcam much, so I didn't mind the trade-off, but heavy webcam users may find it a difficult design choice to live with.

Another big, welcome change is the practically invisible 6mm bezel around the sides and top.

The last big change from the previous model is a bigger battery. Lenovo's replaced the Yoga 900's 66 watt-hour model with a 78WHr unit in the 910. The company says this upgrade increases the battery life during local video playback in the 910 by one hour—while the Yoga 900 claimed eight hours, the 910 claims nine. However, in our testing, we actually exceeded that figure (more on that later).

The Chassis

Aside from small differences, the overall shape and design of the Yoga hasn't changed. The revamped chassis is actually a tiny bit thinner, shrinking ever so slightly from 0.59 inches to 0.56 inches in the 910. Its

depth saw a similar reduction, going down by an scant 0.02 inches. Yet strangely, the overall weight has increased, from 2.86 pounds for the Yoga 900 to 3.04 pounds for the Yoga 910. That's still not terribly heavy for a convertible ultrabook, and it puts the Yoga 910 on equal footing with the updated and seemingly evenly matched HP Spectre x360 (go.pcworld.com/hpx360).

Port selection is quite limited due to the laptop's thin design.

The Yoga's trademark watchband hinge is still in place, looking as dazzling as ever. It allows for full rotation of the display, meaning you can use it as a traditional laptop or tablet, or just prop it up in a tent shape for screen-viewing.

The keyboard is easy and comfortable to use, despite its shallow travel, and it has an excellent feel overall. It offers an adjustable backlight with two brightness settings. The trackpad is also perfectly accurate and is one of the best we've used on a laptop from any manufacturer.

Port selection is quite limited due to the laptop's thin design. On the

right side, you get a headset jack and a lone USB 3.0 port that features always-on charging. There's also a tiny button that allows you to enter the recovery environment or boot menu. The left side features a USB Type-C port that supports USB 3.0 and video out (DisplayPort natively or HDMI and VGA with a dongle). The power connector is actually a USB 2.0 port, but uses a USB-C connector—and strangely, it's the only USB-C port you can use to charge the machine. Unfortunately, to create a more tapered chassis, Lenovo didn't include an SD card reader. And despite its growing adoption, the company didn't include support for Thunderbolt 3.

Performance

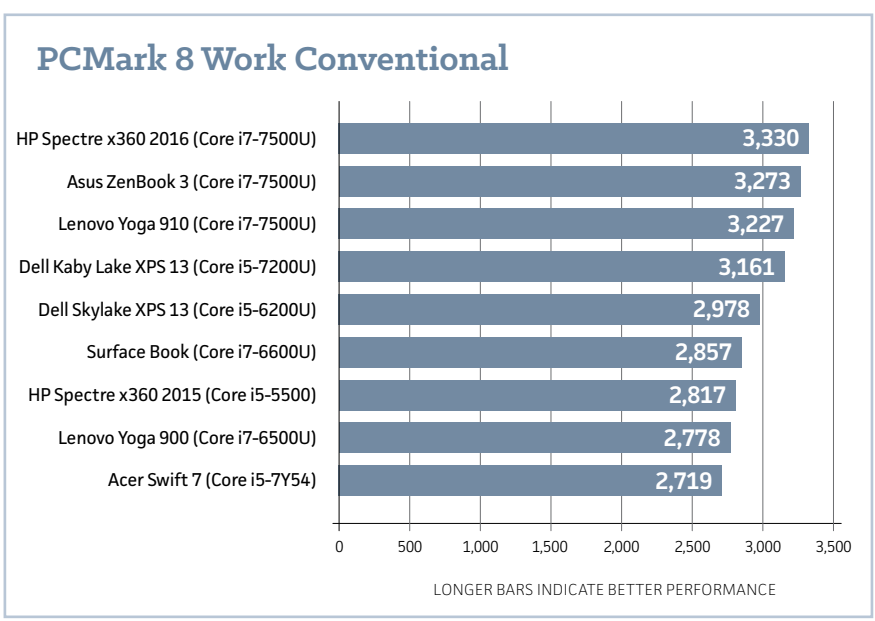
Given the nature of convertible ultrabooks, there's not much room to alter the notebook's guts—nor the ability to go off in an unexpected direction with the internal design. So, much of the Yoga 910's competition has extremely similar specs. Its biggest rival, the HP Spectre x360, has an almost identical configuration. The Dell XPS 13 (go.pcworld.com/xps13r) is similarly rigged-out, despite its traditional

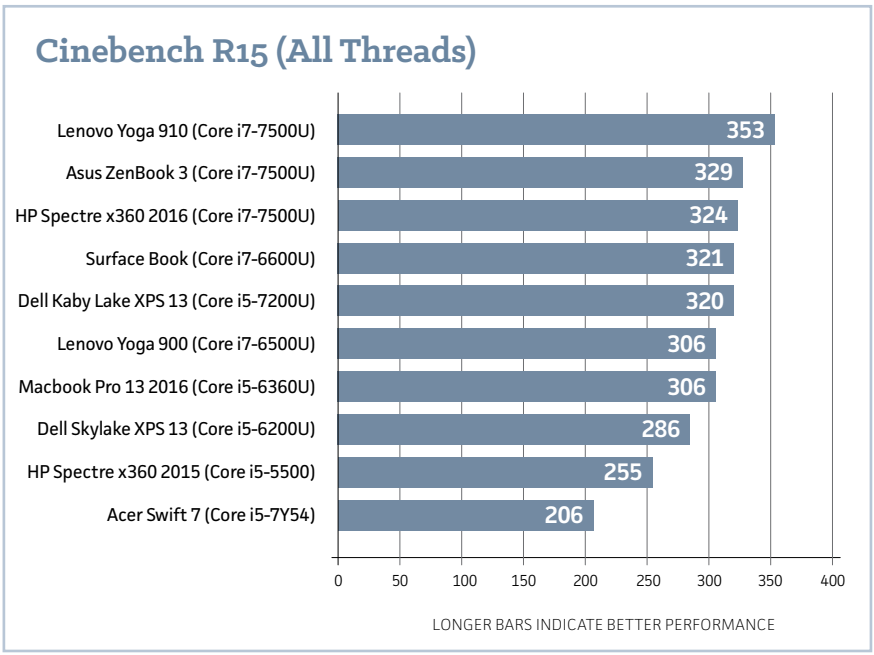
form factor. The Acer Swift 7 (go.pcworld.com/swift7) also shares many of the same specs, but uses a lower-end Kaby Lake processor. Asus's Zenbook 3 (go.pcworld.com/znbk3) uses the same Kaby Lake CPU as the Yoga 910. And then there's the Surface Book i7 (go.pcworld.com/sbi7). It's a crowded field, so let's see how the Yoga 910 fared.

PCMark 8 Work Conventional

Given this notebook's design and configuration, it'll likely spend much of its life regurgitating spreadsheets and Word docs. We also envision a lot of PowerPoint in its future. To test its chops in this buttoned-down environment, we ran PCMark 8's Work Conventional test, which simulates a typical office workload: word processing, web browsing, video calling, and light spreadsheet editing.

In no surprise, the Yoga 910's score of 3,227 makes it well-equipped for office work. (For context, any machine scoring 2,000 or above will sail along smoothly during these low-intensity tasks.) Among its





convertible ultrabook peers, the Yoga 910 finished near the top of the heap, no doubt thanks to its speedy Kaby Lake CPU. Its overall score was 12 percent faster than the Skylake-based Surface Book i7, and 8 percent faster than the Skylake XPS 13—the XPS 13's stronger showing is likely due to the more powerful cooling in that laptop.

Against the similarly equipped Zenbook 3, the Yoga 910 tied it exactly—their matching CPUs might have dictated the outcome. The HP Spectre x360 comes out on top, but its edge falls within the narrow margin of variance when running the benchmark. Overall, the Kaby Lake systems are about 10 percent faster than their Skylake counterparts, which is what Intel promised.

Cinebench R15

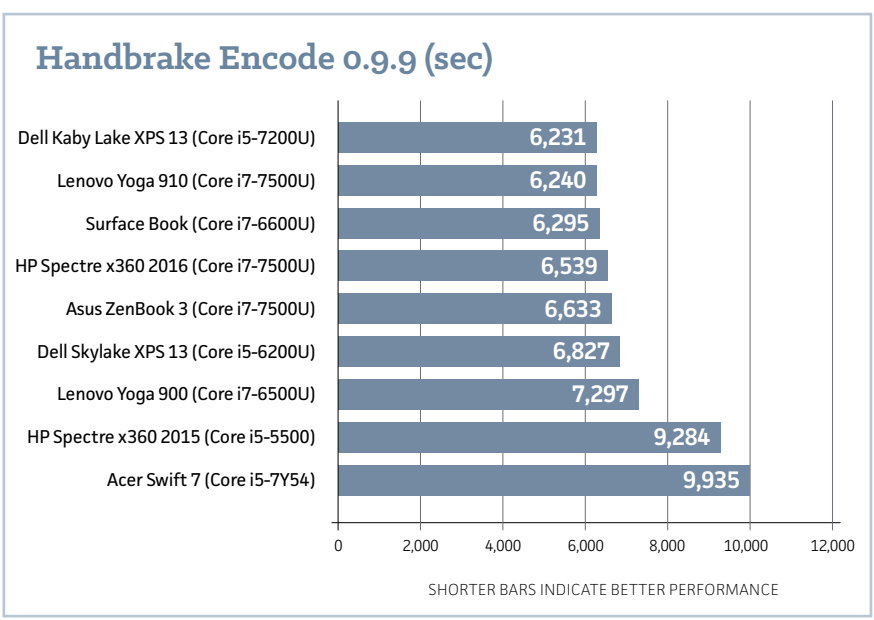
Even if a Yoga 910 is business-minded, it may still have to grapple with the occasional brief CPU-heavy task. Accordingly, we fired up

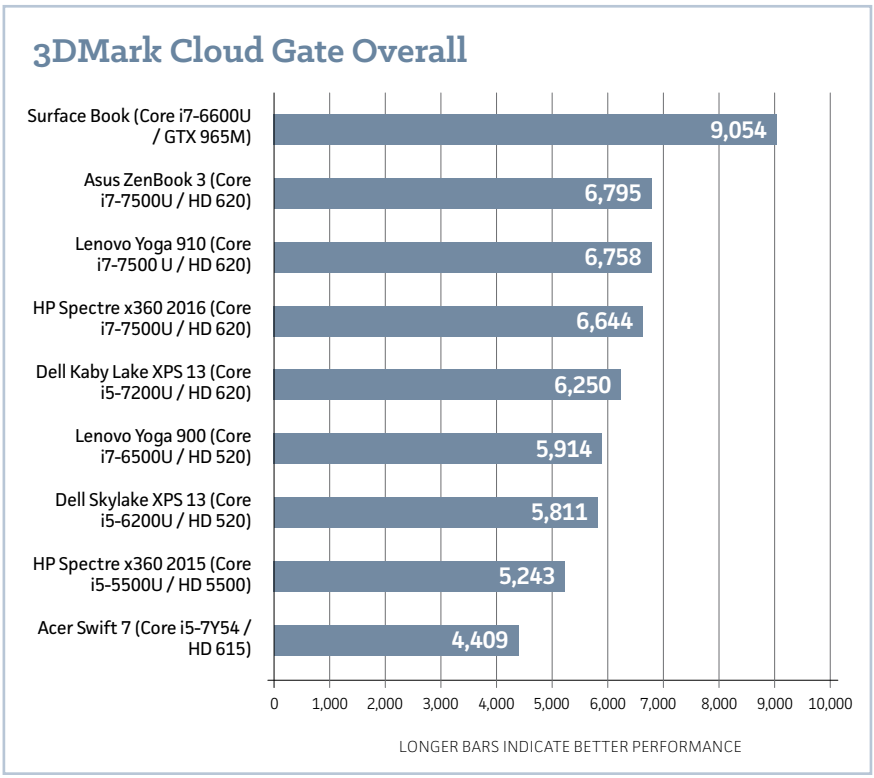
Cinebench R15, a 3D rendering benchmark that puts intense stress on the CPU for a few minutes. It's a demanding test for any processor and scales well, too.

Once again, the Kaby Lake U processors are an average of 9 percent faster than their Skylake predecessors. The Yoga 910 is the fastest ultrabook we've tested thus far. Its lead on the new MacBook Pro 13 and its Skylake CPU was even wider than the average of 10 percent—in this test, the super-slim Yoga 910 was 15 percent faster. Surprisingly, it was also nine percent faster than the HP Spectre x360, despite the fact that the HP has the same CPU as the Yoga.

Handbrake

For ultrabooks, this CPU benchmark is more of a torture test than anything else: Using Handbrake to convert a 30GB MKV file into a smaller MP4 using the Android Tablet preset hammers hard on a processor. Handbrake will eat up as many CPU cores as it can while it





encodes. You can't get much more real-world than with this test.

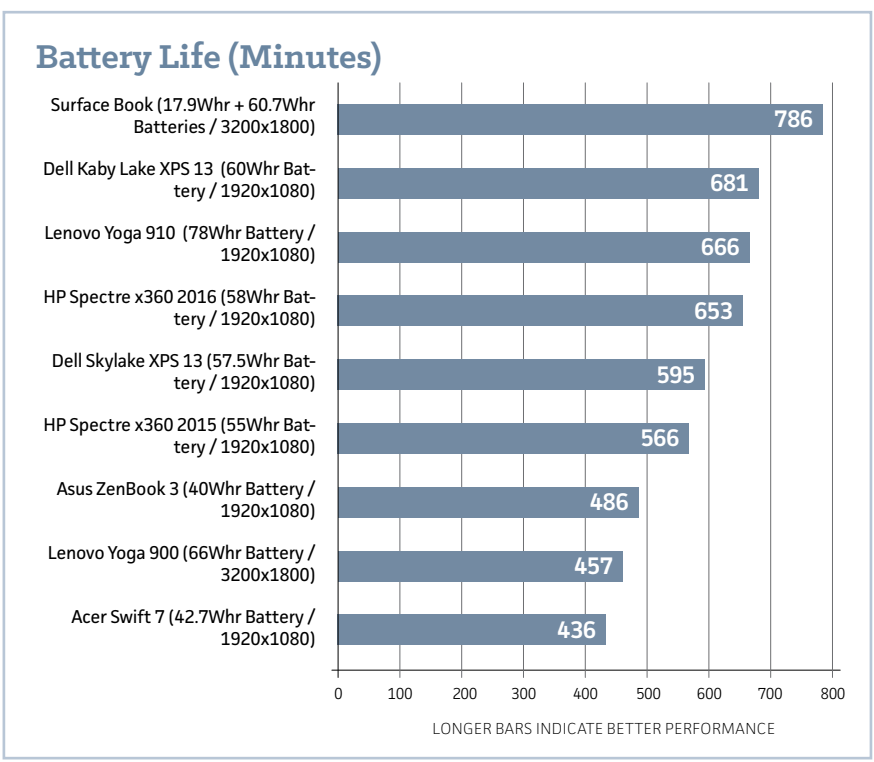
Impressively, Yoga 910 still streaks by most other ultrabooks. A few systems were faster, but by such small margins that it's like a three-way tie. As expected, Skylake machines like the previous-generation Dell XPS 13 ran about nine percent slower than the Yoga 910.

3DMark Cloud Gate

We know that an ultrabook's gaming chops are as thin as its chassis, but some people play very basic games on them anyway. Because the Yoga 910 is a Kaby Lake system, it rocks Intel's new HD 620 graphics, which has the same specs as its predecessor, the Intel HD 520.

However, given the overall improvements to the processor, it's reasonable to assume the Yoga 910 will show a modest boost in gaming performance.

3DMark's Cloud Gate benchmark i's a lower-resolution test that runs at 720p and is designed for low-power notebooks. Compared to the 2016 Skylake Dell XPS 13, which runs Intel's HD 520 graphics, the Yoga 910 was 16 percent faster overall. That's about what we expected. The Yoga 910 was also 28 percent faster than the Broadwell Spectre x360's older HD 5500 chip. Of course, we're examining this within a very narrow context—this doesn't mean the Yoga 910 is a fast chip. It's still integrated graphics running on a 15W CPU. Still, it does appear to be moderately faster than the HD 520 in Skylake processors.



Battery Life

Given the Yoga 910's size, this ultrabook's 78WHr battery is impressively large. More impressive is how it performed in our 4K video playback test, in which we run down a fully charged battery by playing a 4K UHD file on loop in Windows 10's native Movies & TV app with sound on. Lenovo claims a battery life of nine hours for video playback, but that estimate is likely for the configuration sporting a 4K UHD (3840x2160) screen. On this 1920x1080 base model, we got a fantastic 11 hours and six minutes.

That performance places the Yoga 910 in the top tier of our battery tests. It's no match for the ridiculous 13 hoursfrom the Surface Book i7, but remember it has two batteries, making it a bit of an outlier. Back in the single-battery world of most laptops, the Yoga 910 hews closely to the HP Spectre x360 and the Dell XPS 13, which were all around 11 hours as well. This is a superb result, as it exceeds what we would consider "all day."

It has class-leading battery life, a gorgeous display with a mostly razor-thin bezel, and excellent performance.

Conclusion

The move to Kaby Lake certainly has boosted performance, but the Yoga 910 has a lot more going for it than just the latest CPU. Any company can shoehorn a new CPU into a chassis. The Yoga 910 is a seriously improved laptop over the 900 in all the ways that count—it's easily one of the best convertible notebooks available. Even if you never bend it into other shapes, it's still a fantastic ultraportable. It has class-leading battery life, a gorgeous display with a mostly razor-thin bezel, and excellent performance. And at $1,049, it's also less expensive than its competition. Sure, the webcam's placement isn't ideal, and its slim stature means you're short on ports, but those are trade-offs we can live with, given the Yoga 910's otherwise stellar attributes.

Linksys Velop Wi-Fi router: One of the best mesh network systems to date

BY MICHAEL BROWN

LINKSYS BID ITS time before jumping into the consumer mesh Wi-Fi router market, watching Eero, Luma, Netgear, and Google wade in with new products in 2016. Now, Linksys is making a splash at CES where it debuted its Velop Whole Home Wi-Fi system. We've benchmarked the heck out of a three-node system and found it to be

one of the best yet. It's also one of the most expensive, with a single router priced at $200, a two-pack at $350, and a three-pack going for $400 (a substantial discount over buying three singles).

You'll find benchmarks conducted with Windows PCs further down, but I performed the same tests with a MacBook Pro. Click here (go.pcworld.com/veloprev) if you'd prefer to read that version.

The Velop's slightly rounded columnar form factor hews closer to Netgear's Orbi (go.pcworld.com/orbi) (next on my review to-do list) than the puck-shaped devices from Eero (go.pcworld.com/eero) (benchmarked, but not officially reviewed yet) and Google (Google Wi-Fi has been fully reviewed go.pcworld.com/gglewifi). And like the Orbi, the Velop is a tri-band router with three 2x2 radios (two uplink and two downlink) operating three independent networks on the 2.4- and 5GHz frequency bands. One of the 5GHz networks utilizes the lower channels on that band (36 and up) while the other uses the upper channels (149 and up). The router automatically steers clients to the most appropriate network, and each automatically chooses a different channel for its backhaul duties (i.e., data traveling from client devices back to the router). You can also set up one guest network.

The Velop's off-white vertical enclosure is perforated with ventilation holes on the left side, the back, and the top. With its six antennas hidden in the top of its enclosure, and its cables emerging from a cutout in one corner, the Velop looks more like a room air freshener than a router. But that's typical of mesh routers—manufacturers are doing their best to design network devices that consumers won't object to placing out in the open. Be that as it may, everyone who buys an understated mesh router will still need to plug it into their ugly

Velop Whole Home Wi-Fi

AT A GLANCE

The Linksys Velop is one of the best true mesh-network routers we've tested, but many Wi-Fi enthusiasts will still prefer a more conventional model.

PROS

- Robust feature set
- Exceptional performance under stress (and at range, with two nodes or more)
- Attractive, unobtrusive industrial design

CONS

- Only two ethernet ports
- No USB port for storage or printer support
- Expensive

★★★★½

old broadband gateway. I suspect a lot of these routers will still end up in closets, but the access points might see the light of day.

A single multi-color LED on top reports the Velop's status, and there's a silver Linksys logo printed on its solid face. Two ethernet ports and a power connection are located inside a two-inch-deep well inside the bottom of the unit. There's an on/off switch and a reset button here as well (you won't need to bend a paperclip to reach the latter).

The ethernet connections automatically configure themselves for WAN or LAN duties, and each satellite Velop can also function as a wireless access point or a wireless bridge for clients that would otherwise need to be hardwired to your network. You'll need a smartphone or tablet to set up and configure a Velop router, as there is no web client. The app (there are Android and iOS versions) pairs with the router's Bluetooth 4.0 radio and then steps you through the rest of the process, which includes setting a Wi-Fi password for the router.

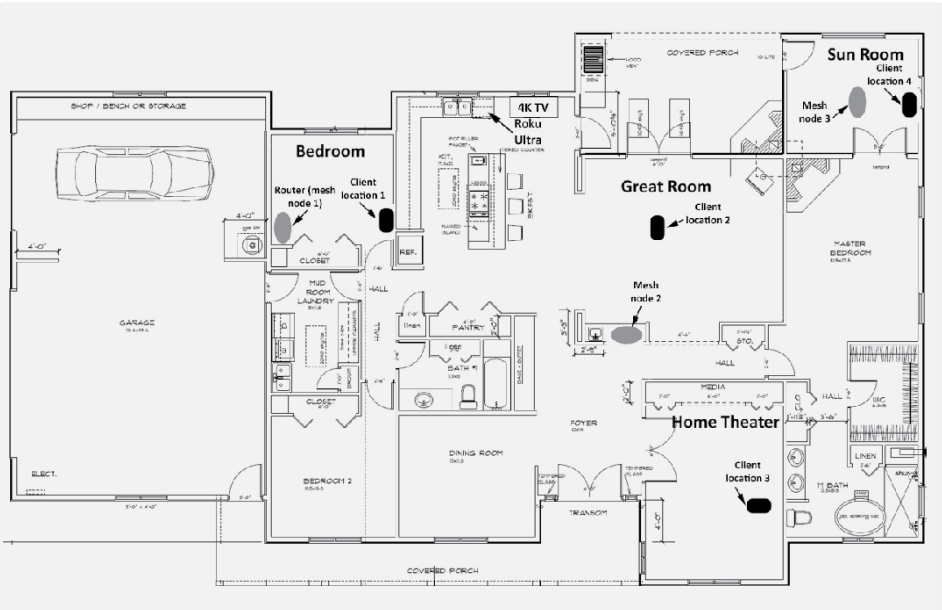
As you add each node, the app automatically evaluates the strength of its connection to the next closest node and will suggest moving it

The Linksys Velo offers generous ventilation for its quad-core ARM CPU, 512MB of DDR3 memory, and 4GB of flash storage. Cables emerge from the notch in the corner.

closer if the connection is weak. Bluetooth discovery process took longer than we've experienced with other mesh routers, and Linksys tells us there's a bug that causes the app to time out if you leave it to do something else. The wait is annoying when you're setting up a three-node system as I did, but you only need to do it this once.

Linksys says the Velop will work with Amazon's Alexa digital assistant, but that feature wasn't ready in time for us to review. Once Amazon certifies the Velop skill, you'll be able to use voice commands to turn its guest network on and off and request login credentials for its main and guest networks. We'd also like to see support for prioritizing client devices with voice commands—you can select up to three devices for bandwidth priority if your internet connection is constrained. (As it stands, you'll need the app to perform these tasks yourself.) The Velop app also has basic parental controls.

Two ethernet ports (the router auto-configures these as WAN or LAN ports) are recessed inside the base of the router along with the power connector to reduce cable clutter.



Benchmark results

If you live in a smaller home or an apartment, you might be able to get away with a single Velop. When the client PC was in the same room as the router, nine feet away and without any walls between the two, it delivered TCP throughput of 431.7 megabits per second. That's almost as fast as the conventional router I compared it to (a Linksys EA9500, which managed 443.7 Mbps), and it's faster than a Google Wifi (401.3Mbps). But the Eero WiFi System was faster than all three, scoring 463Mbps.

The EA9500 delivered the best performance when the client was further away, in my great room. That puts the client 33 feet from the router, with a wall, plywood cabinets, and several kitchen appliances in the signal path (a refrigerator, double wall oven, island-countertop range, and a ceiling-hung ventilation hood). The Eero and the Google Wifi were the highest-performing mesh routers at this location (while operating with one node each, that is).

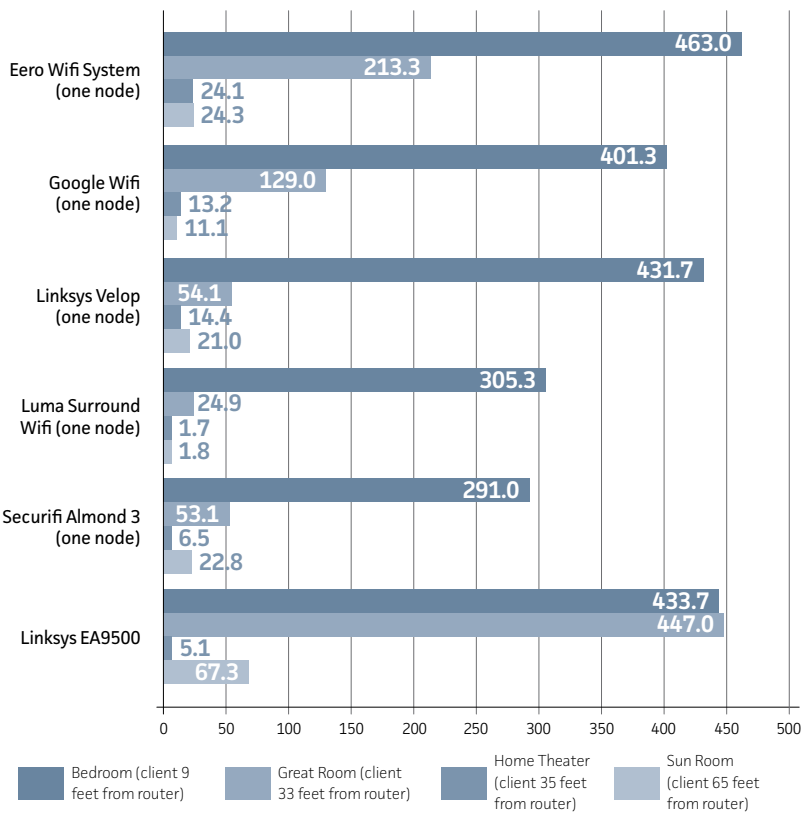
This floorplan shows where the router, mesh nodes, and clients were placed for benchmarking.

One Velop node wouldn't be sufficient for my 2,800-square-foot home; then again, none of the single Wi-Fi routers I've tested can sufficiently penetrate my well-insulated home theater—at least not wirelessly.

Adding a second Velop node was enough to blanket my entire home with Wi-Fi coverage, including the home theater. The Velop delivered impressive throughput of 145Mbps there and 128.7Mbps in the sun

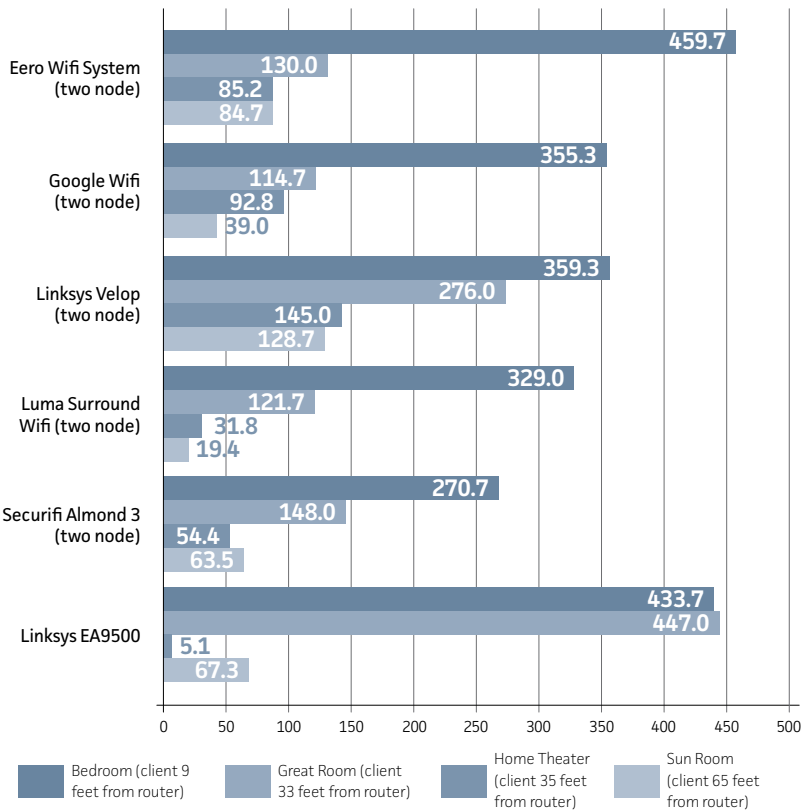
Mesh Wi-Fi Router comparision

TCP THROUGHPUT WITH EACH MESH ROUTER OPERATNG SOLO
CLIENT: HP ENVY X360 WITH 2X2 INTEL DUAL BAND WIRELESS-AC 7265
LINKSYS EA9500 ROUTER AS BASELINE



Mesh Wi-Fi Router comparision

TCP THROUGHPUT WITH EACH MESH ROUTER USING TWO NODES
CLIENT: HP ENVY X360 WITH 2X2 INTEL DUAL BAND WIRELESS-AC 7265
LINKSYS EA9500 ROUTER AS BASELINE

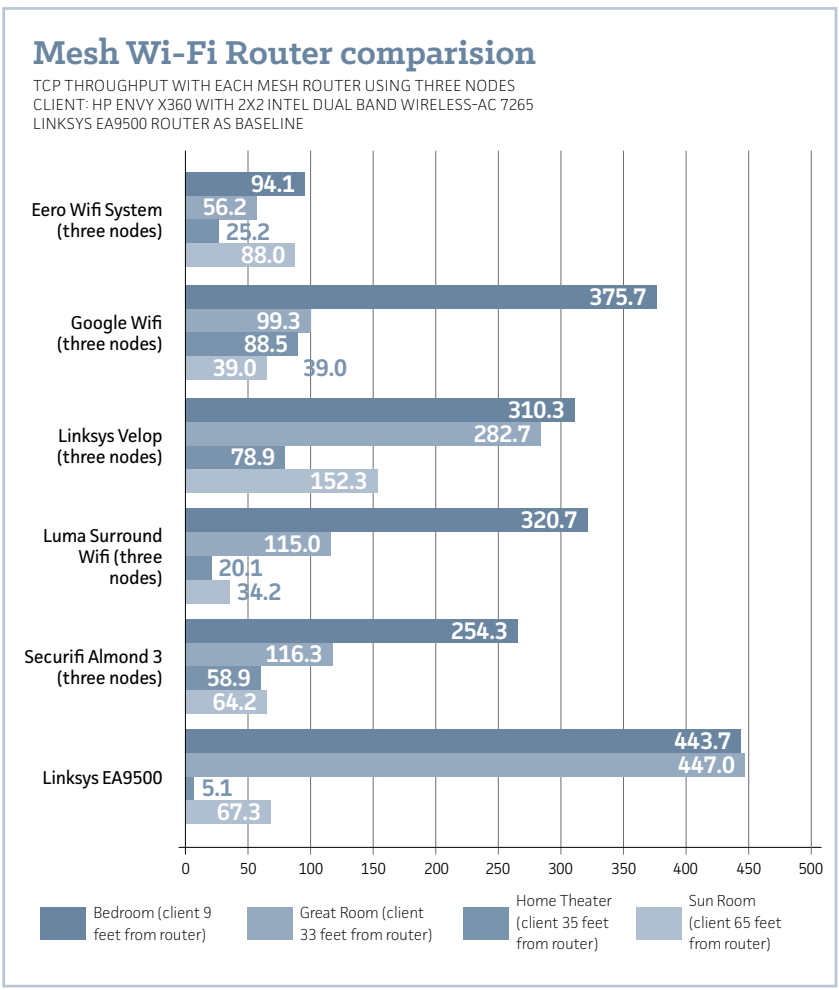


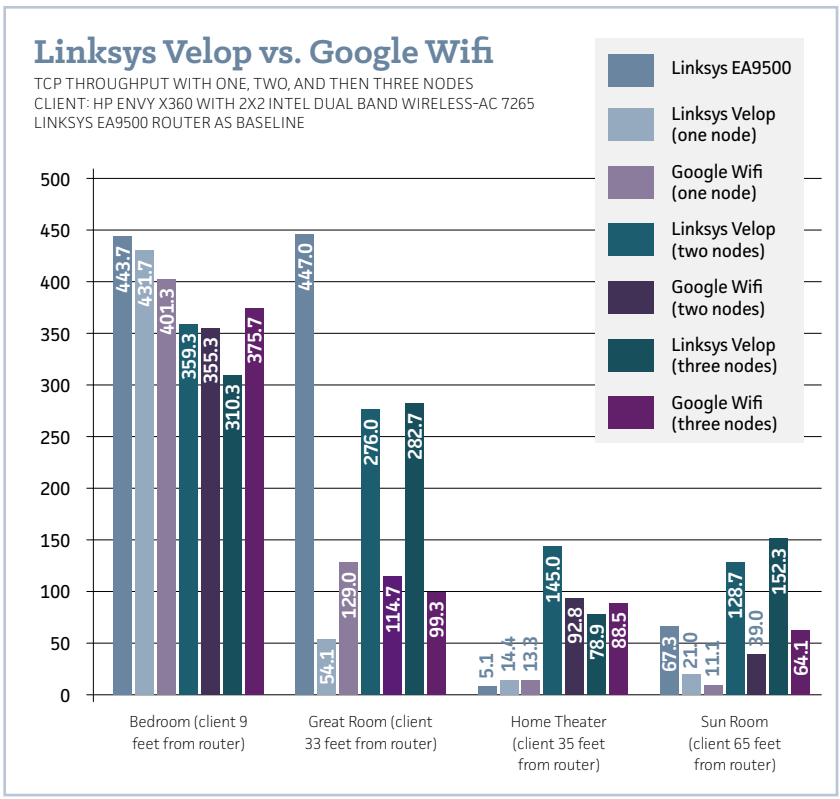
room, which is 65 feet from the router with three insulated interior walls and two fireplaces in the signal path.

Adding a third node was overkill for my space. Performance at three locations increased, but I saw lower throughput in my home theater for some reason. If adding a third node increased the hops the packets had to make, I would have thought it would impact all four test

locations. If I lived in a large multi-story home, on the other hand, I think I would spring for that third node anyway. Buying a two-pack and adding the third later would cost $50 more than buying a three-pack to begin with.

As you can see from the chart below, performance at close range declined as I added nodes, but throughput went up at each of the





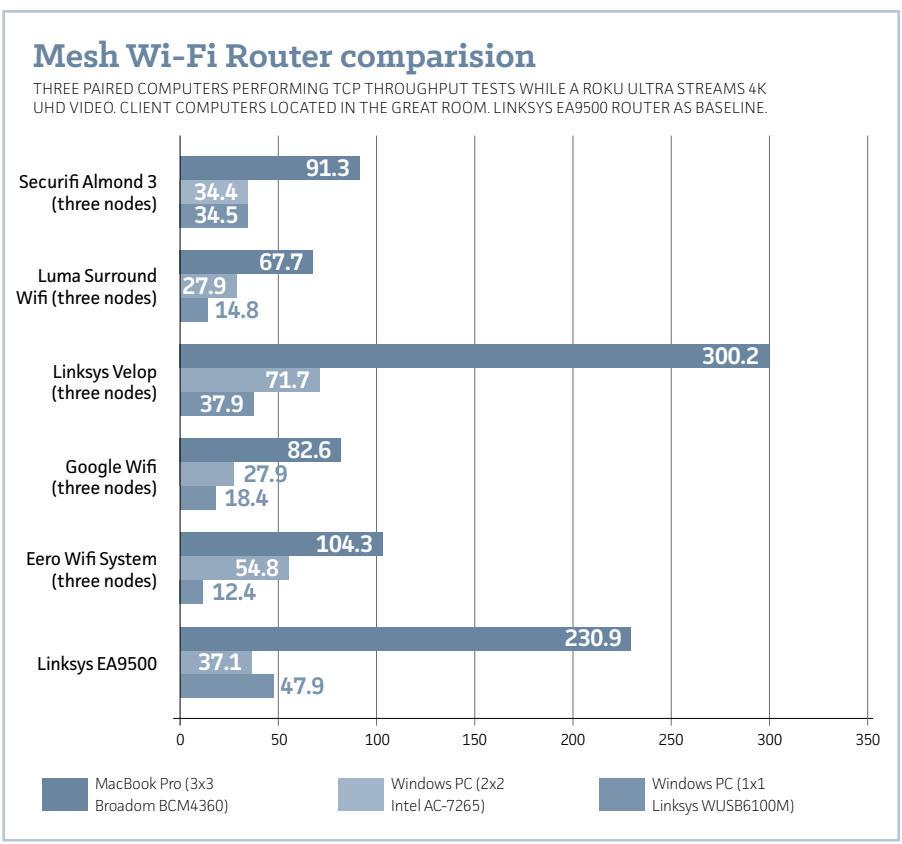
The turquoise-shaded bars show the Linksys Velop router's performance. The purple-shaded bars represent the Google Wifi.The gray-blue bar tracks the performance of the conventional Linksys EA9500.

further test locations (with the notable exception of the home theater). The tradeoff for having a wireless access point closer to each client is having the packets make additional hops to and from the router.

The chart above compares the baseline Linksys EA9500 to the Linksys Velop and Google Wifi with one, two, and then three nodes deployed. None of the mesh routers delivered fantastic range when deployed solo, but adding nodes almost always paid dividends.

Adding a range extender might help the EA9500, but a range extender can significantly reduce overall throughput because a chunk of the router's bandwidth is used for backhaul. That doesn't happen with mesh networks, and adding Velop nodes significantly increased throughput compared to Google's product, as you can see in the chart below.

My final performance chart shows how the Linksys Velop performs under pressure. For this test, I run wireless TCP-throughput benchmarks on three pairs of computers (four Windows machines and two MacOS computers) placed 33 feet from the router while



simultaneously streaming 4K video from a Roku Ultra streaming box that's wirelessly connected to the network (with three active nodes).

The Velop crushed the competition on this one, including its cousin, the Linksys EA9500. It was more than twice as fast than some of the other routers.

Notice how much higher the MacBook Pro's numbers are compared to the Windows machines? That's attributable to Apple's choice of a 3x3 Broadcom Wi-Fi adapter. The vast majority of Windows laptops, including the HP Envy x360 I used, have 2x2 Wi-Fi adapters. I plugged a Linksys WUSB6100M USB Wi-Fi adapter into the second Windows laptop, which is an older machine with an 802.11n adapter onboard. While the WUSB6100M is only a 1x1 part, it offers native support for MU-MIMO.

Is the Linksys Velop right for you?

The Linksys Velop is one of the best mesh networks we've tested so far. It offers a strong collection of features, very good performance, and comes with a three-year warranty with 24/7 tech support. Eero's comparably priced system delivers higher throughput at close range, but you don't gain nearly as much throughput with additional nodes compared to what Linksys delivers. The Velop is also the only one of the three routers to support MU-MIMO right out of the box. While there aren't a lot of MU-MIMO client devices on the market right now, you won't have to wait for a firmware update if you own one.

Linksys shipped the new router on January 15.

Samsung 960 Pro NVMe SSD: Ludicrously fast PC storage

BY JON L. JACOBI

WHEN I WAS testing Samsung's new 960 Pro M.2/NVMe SSD (go.pcworld.com/ss960proamz), a coworker looking over my shoulder at the results declared, "That's sick!" High praise in today's parlance, and a direct response to this drive's incredible speed. It's a phrase I continued to voice silently as I saw read and write numbers of 2.7GBps and 1.7GBps, respectively, pop up. And that was from the super-conservative AS SSD benchmark with non-compressible data; CrystalDiskMark 5 boasted reads and writes of 3.5GBps and 2.17GBps, respectively, with a 2GB data set. Whoa.

Price and capacity

At the time of this writing, the 960 Pro is priced around 63 to 72 cents per gigabyte on Amazon: $372 for the 512GB version, $630 for the 1TB model, and $1,299 for the 2TB version. That's right, there's a 2TB model thanks to the Samsung 3D/stacked-layer NAND employed on the drives. If you've been holding off on M.2/NVMe because of the relatively low capacity (1TB isn't enough?), then the 960 Pro should eliminate that argument, if not the cost issue.

The warranty for the 960 Pro is basically five years, or 400TBW (terabytes written) for the 512GB drive, 800TBW for the 1TB model, and 1,200TBW for the 2TB version. Yes, less of a warranty for your $1,300. Go figure. Our best guess is that getting to 2TB required using less over-provisioning, i.e. NAND set aside to replace failed cells. Regardless, all three ratings are far more than most users will hit over the warranty period, and probably a lot longer.

Testing, retesting…

The write numbers I quoted above are absolutely real, but it took a bit of effort plus a retest to get them. My first test with AS SSD, which uses the FUA (Force Unit Access) command to bypass all caching (for Windows and the drive), saw only 170MBps writing. Not unexpected. What was unexpected was 170MBps in our real-world write tests, which don't force access. It was puzzling, but I'm guessing that by running these tests immediately following AS SSD, the early 960 firmware was still obeying the FUA command.

Other oddities ensued, and then the drive itself died (this happens from time to time with review hardware). The replacement drive I received performed more as advertised. Even in AS SSD, where it really shouldn't have, given bypassed caching. I'm still investigating, but Samsung hasn't chimed in at press time. The upshot is, you should get the numbers I quote as long as you don't turn off write caching for the drive (Device Manager >

Samsung 960 Pro M.2/NVMe SSD

PROS

- Insanely fast with large files
- Up to 2TB capacity

CONS

- Just average with small files
- Pricey

$630

★★★★½

Samsung's scintillatingly fast 960 Pro M.2, PCIe/NVMe SSD.

Disk Drives > Drive Properties > Policies).

The 960 Pro ships with 1MB of DRAM cache for every 1GB of NAND. If the 960 Pro is like other SSDs, a relatively small percentage of that is used for write or read caching, with the majority used for data allocation tables (copied from the NAND). But with the speeds I saw, I'm guessing DRAM caching might play a bigger part than with, say, a SATA SSD.

Whatever Samsung is doing, it works. The 1TB 960 Pro we tested is a beast in the very best sense of the word. Check out the 960 Pro's bars on the next page. Impressive.

On the other hand, the real-world copy tests displayed some mild improvement in sustained throughput, but also revealed the practical limits of what a "faster" NVMe SSD can do for you. While the benchmarks show drastic improvement, real-world copy performance and hands-on, subjective Windows performance don't mirror them. That's of course comparing the 960 Pro to other NVMe SSDs, the slowest of which eliminates most storage lag. Compared to SATA hard drives or SSDs? We're talking light years better.

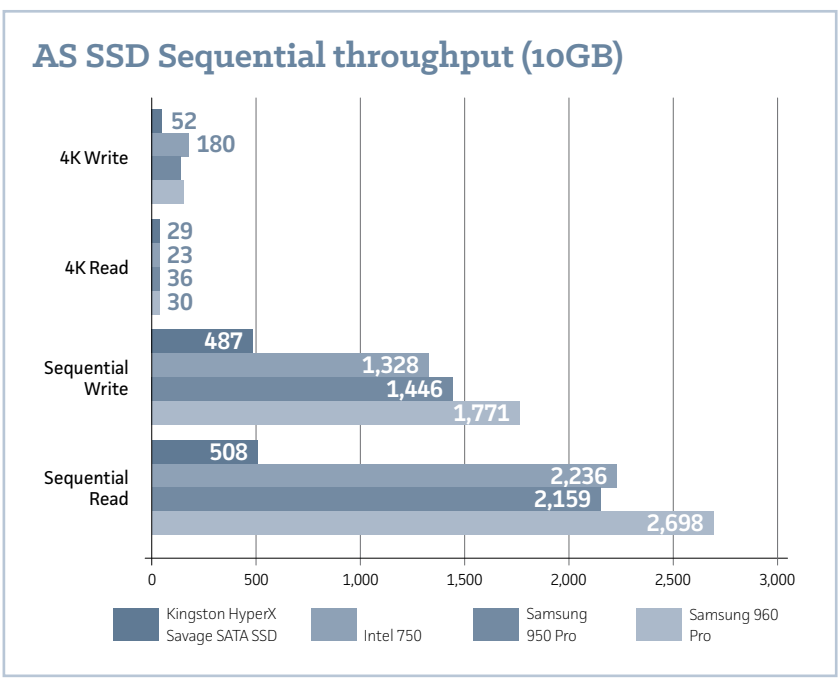
As you can also see, the Intel 750, which is a PCIe card SSD and not suitable for laptops, is very fast with the 20GB folder of smaller files. Intel has previously informed us that the company's SSDs are tuned specifically for servers with their high volume of I/O requests for smaller bits of data, and closely interact with the company's Rapid Storage Technology (RST) to some benefit. That's my guess about the drive's dominance in that test.

The 960 Pro turned in great numbers. What do they mean? So much of what makes Windows and applications seem slow is storage-related, so switching to any NVMe can make a system seem sensationally faster. As for the 960 Pro in particular, it's easily the best consumer NVMe SSD for those who deal regularly with large files. The only caveat is that your system must support booting from NVMe to make the best use of it (i.e., make the operating system faster). Many PCs do not.

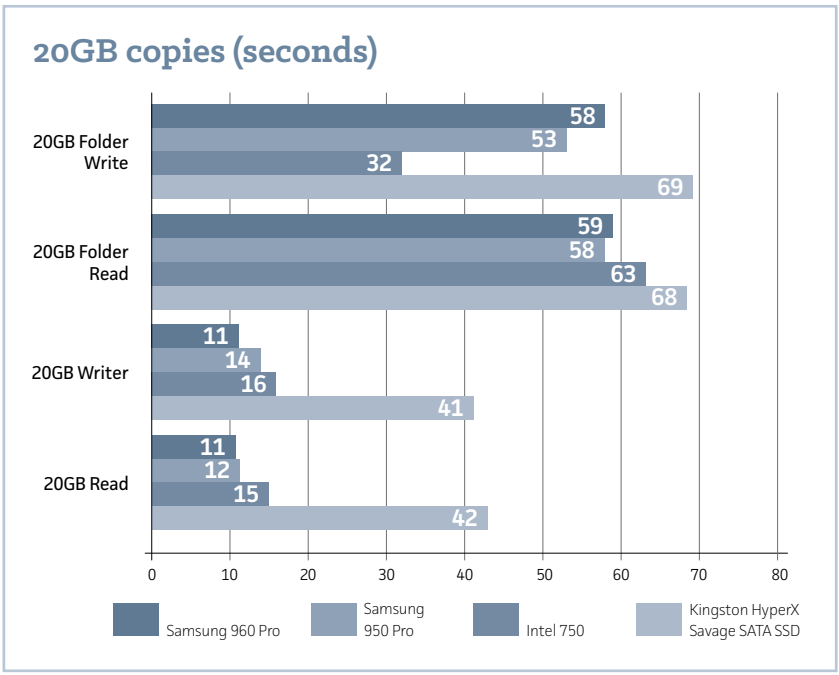
Note: The 512MB version of the 960 Pro is a bit slower due to fewer chips and channels to distribute the data over.

Conclusion and buying advice

If your laptop or desktop supports the 960 Pro, then it's the consumer-grade NVMe SSD you want. Assuming the price is competitive, that is.



When it comes to benchmarks, the 960 Pro blows away the competition. And the benchmarks generally are indicative of the impact on everyday Windows performance.



For sustained throughput, the 960 Pro shows significant improvement on the 950 Pro and is quite a bit better than Intel's 750. But the smaller file and folder write numbers (at the top) are actually a bit worse than the previous generation.

If you find others at substantial savings, you'll be nearly as impressed. Copying 20GB in 11 seconds as opposed to 12 isn't an earthshaking difference, and the 960 Pro is merely average for an NVMe drive when it comes to smaller data requests.

Where the 960 Pro is truly unique is in offering 2TB of storage on a single 2,280mm stick—a huge plus for deep-pocket users dealing with lots of data. But for PCs, or laptops with two drive bays, it's nearly as effective to get a smaller NVMe SSD for your OS, and use a larger SATA SSD or hard drive for auxiliary storage. I run my work system that way and rarely notice the difference.

That said, if someone dropped a 2TB 960 Pro in my lap, I'd gladly alter my setup to accommodate it.

Razer Kraken V2: Two headsets, one leap forward

BY HAYDEN DINGMAN

AFTER THE RELEASE of this year's Man O' War (go.pcworld.com/razermanowarrev) headset, I figured it was only a matter of time before Razer got around to updating its more mass-market design—it came even faster than I expected.

Just in time, too. The Kraken 7.1's been an also-ran for years now, a chintzy headset backed by underwhelming audio. The 2016 Kraken V2—both the analog Pro variant (go.pcworld.com/krakenalv2amz) and especially the USB-powered 7.1 V2 (go.pcworld.com/krakenchrv2amz)—changes that, arriving packed with most of the Man O' War's improvements: better audio, a sturdier design, and a more refined look. Sure, it's just as bulky as ever, but this is the Kraken's best showing in a long time.

Growing up

If Razer had only changed the Kraken V2's aesthetic, it'd already be a huge improvement over last year. Some people might really love the Kraken's old street-punk style, with its DayGlo colors and scratched-out logo, but I always thought it was a bit out of sync with the rest of Razer's products, especially in the last three or four years.

The Kraken V2's look is a total visual overhaul. It's now black everywhere: on the ears and headband, plus an upgrade to black aluminum for the earcups and chassis. The branding's also the same shade, with the new, subtler Razer logo embossed right into the headband.

Logos matter, and you can see it in the Kraken. The headband branding is the only design difference between the Kraken V2 and its predecessor, but it has a positive effect. The Kraken previously felt like some

Razer Kraken 7.1 Chroma V2

$100

★★★★★

Razer Kraken Pro V2 Analog Gaming Headset

$80

bargain peripheral, something left on a shelf in a Best Buy five years ago. This latest iteration pivots towards a more refined adult look.

It's a smart move. Not only have other manufacturers like Logitech and SteelSeries already made the same shift, but it brings the Kraken aesthetic in line with the rest of Razer's products.

Not that the Kraken V2 is a perfect design. It's still much bulkier than any headset I've reviewed recently, with the exception of Razer's own Man O' War. And just like the Man O' War, the Kraken gives you that bizarre Princess Leia side-bun look.

Looks aside, though, I can't pick at the silhouette too much. The V2's not an especially heavy headset—most of its bulk comes from the inch-thick foam on each ear and a liberal amount on the headband too. That foam is so comfortable, too. I called the Man O' War "pillowy" earlier this year, and the Kraken V2 warrants the same description. You can wear the Kraken V2 for hours without discomfort, aside from a bit of warmth around the ears. (That's the price we pay for leatherette.)

A few differences separate the USB-enabled Kraken 7.1 V2 and its less-expensive analog cousin, the Kraken Pro V2. The Kraken 7.1 V2 features RGB lighting on each ear, with an illuminated Razer snake logo. It also has a red band around the end of the retractable mic to indicate whether you're muted—a function controlled by clicking the end of the microphone.

The Pro V2 has zero lighting. No decorative ears, which is fine, but sadly no mute indicator, either. However, the Pro V2 does have a control box located about a foot down the cable with a volume wheel and a mute toggle. I'm not a huge fan of in-line boxes, preferring controls on the headset itself, but the weird bit is that the USB-enabled 7.1 V2 lacks any sort of on-the-fly volume controls. This gives the Pro V2 a slight edge in my book, as I like to have volume controls handy.

Also worth noting: The Pro V2's cable is way longer, at least if you connect the dual-terminus (mic/headphone) 3.5 mm cable. The USB version's 6-foot cable can feel a bit limiting by comparison.

Moving to 50mm drivers

The biggest change to the Kraken V2 can be found under the hood: 2016

marks the first use of 50mm drivers inside. The Kraken's one of the last gaming headsets to move to the larger size.

Ostensibly, the switch to 50mm drivers over the past few years has been to facilitate bass quality and provide a "larger" sound, though it's worth pointing out that a good 40mm driver will outperform a weak implementation of a 50mm driver. Still, it's an important change for the Kraken, which has been plagued by middling audio for years. The Kraken now hews much closer to the Man O' War, a headset I found rather enjoyable.

Like the Man O' War, the Kraken on its default setting isn't fantastic. It leans a bit heavy on the mids and treble range, without much of the bass punch you'd expect from the jump to 50mm drivers. Simple music like most of Julien Baker's piano-and-voice songs or some of The Band's ouvre sounds fine, but more complex mixes seem a bit lifeless. Everything blends together into one narrow band of sound.

But like the Man O' War, the Kraken's strength lies in its EQ headroom. Swapping between the various EQ presets included in Razer's Synapse software can make a huge difference. When I changed to the "Rock" setting and rolled off the bass a bit—the same settings I used with the Man O' War a few months back—the sound opened up considerably. I got better bass, a more distinct treble range, and the same solid mids as the default setting.

A few things here: 1) Yes, it's still weird that Synapse's EQ settings are named after music presets instead of games. 2) Yes, I'd prefer if the

Kraken 7.1 V2 was a better headset out of the box, as every headset can obviously benefit from EQ tweaks. The difference here though is the degree by which the Kraken changes. Also, it's a $100 headset, so I'm a bit more forgiving than I am with, say, the $300 Astro A50 (go.pcworld.com/astroa50rv).

If you're considering the analog Kraken Pro V2, keep in mind that the default audio is more of an issue. To adjust how it sounds on your PC, you'll need to run your own separate EQ software. And if you don't bother, or if you hook the Kraken Pro V2 to a different device like your phone, you'll notice again that the Kraken's default sound just isn't that great. It's fine, but there are better options out there.

You'll also miss out on the Kraken 7.1's titular surround-sound support, though that's less an issue. The Kraken 7.1 V2 doesn't quite match the Man O' War's soundstage, but it's still pretty wide output compared to most sub-$100 headsets—with the exception of the HyperX Cloud (go.pcworld.com/hyperxcloudrev).

That said, 7.1 isn't much of an upgrade. I'll repeat my old fallback

phrase: "It's good, for a headset." You can calibrate the Kraken's 7.1 audio through Synapse, and yeah, it definitely does a decent emulation of surround sound—about as good as Logitech's similarly priced G633. But it's a far cry from real surround setups, and I prefer to run in stereo mode most of the time.

Props to Razer for making that fairly foolproof, though. Like the Man O' War, the Kraken 7.1 V2 lets you set preferred output through Synapse, meaning you can set Spotify to always default to stereo while games run in 7.1. It's a small but convenient quality-of-life upgrade.

The Kraken Pro's a bit worse off, with a noisier microphone and more nasally sound, but it does get the job done.

As for the microphone, the Kraken 7.1 V2 is the clear winner between it and the Pro V2. It's got a better-quality mic than the Kraken Pro and a bunch of optional tweaks built into Synapse, including active noise cancellation and noise gating. I miss the Man O' War's dedicated microphone volume wheel, but the Kraken 7.1's still got the same features in software and does a good job reproducing voices. The Kraken Pro's a bit worse off, with a noisier microphone and more nasally sound, but it does get the job done.

Bottom line

It's a big year for Razer. Less than six months ago, I was ragging on the outclassed Kraken in my Man O' War review. Now the Kraken's folded in many of the Man O' War's improvements, but with a durable aluminum design and much more affordable $100 price tag. Not bad.

I'd love to see Razer slim the Kraken down a bit, and add some sort of volume control (even in-line). But for the first time in a long time, the Kraken feels like a viable midrange headset choice. That's good news for all the Cult of Razer folks.

AirPods: They sound great, but Siri holds them back

BY SUSIE OCHS

WHEN APPLE PULLED the headphone jack off the iPhone 7, it also unveiled a new set of wireless earbuds called AirPods, and claimed they were so great, users wouldn't mind the missing headphone jack. The AirPods didn't come out for nearly three months after the new iPhone's release, but now that they're here, they've solved every problem an iPhone 7–using music lover could have, right?

Oh, heavens no. Like so many Apple products before them, the AirPods bring with them as many problems as they solve. With no onboard buttons, the AirPods require users to ask Siri to do everything, from changing a track to adjusting the volume. What's more, Siri doesn't have the same abilities in all music apps—an arbitrary restriction set by Apple to steer you toward Apple Music.

The fit

But let's start with the first question everyone has about the AirPods. Aren't you worried they will fall out of your ears? As soon as they were announced, even Conan O'Brien had to make fun, producing a parody of the old iPod commercials (youtu.be/z_wImaGRkNY), only with AirPods flying off in all directions with the slightest move of the dancers' heads.

That's funny, but it's bull. The AirPods stay put when I'm dancing, head banging, jogging, hanging upside down, riding my stationary bike, sprinting to catch the bus, and shaking my head around smacking my temple like I'm trying to dislodge water stuck in my ear. Really, they aren't going to fall out. Watch the video on the next page for proof.

AirPods

AT A GLANCE

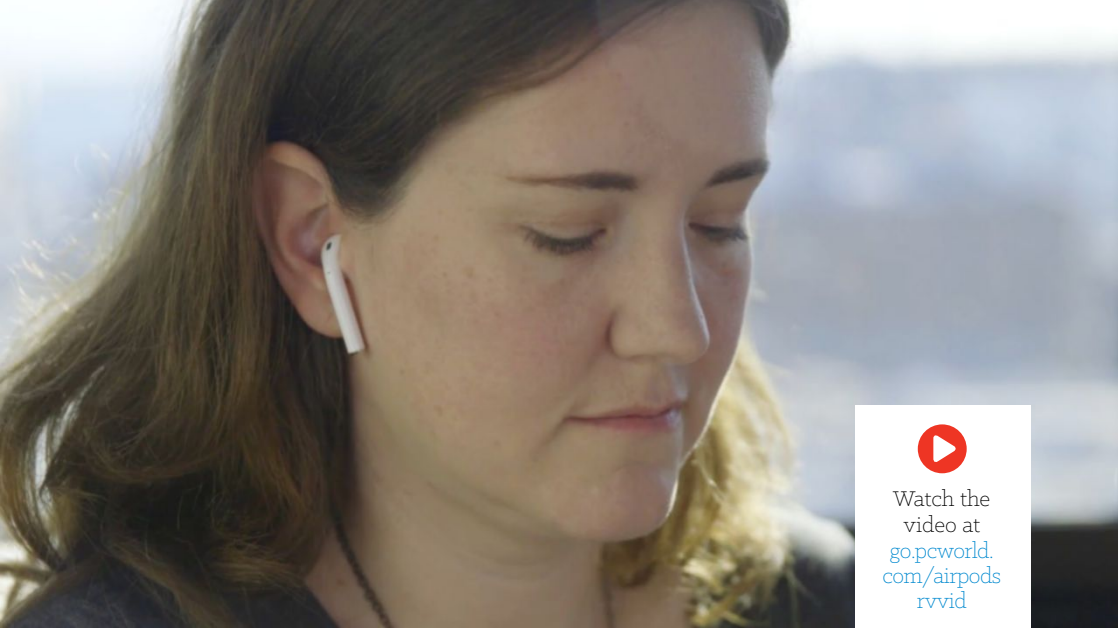
The AirPods have good battery life and great sound, and the integration with iOS can't be beat, but if you listen to your music with third-party apps, Siri is only half as helpful as she could be.

PRICE

$160

★★★★½

The wireless AirPods resemble the EarPods, but the AirPods have a heftier, more substantial design that stays put in my ears.



Watch the video at go.pcworld.com/airpodsrvvid

My skin is on the oily side, and sometimes in-ear 'buds with silicone tips get a little oily, and I have to wipe them off or keep shoving them further into my ears for a good seal. The wired Apple EarPods (you know, the cheap pair that comes with your iPhone) fit me OK, and I've been wearing them since the iPhone 7 launch. But the EarPods wire does trip me up from time to time, getting snagged on armrests when I'm on the bus, or requiring adjustment when I'm wearing a scarf.

So I wanted to go wireless, and knew the AirPods had to be comfortable enough to wear all day, and not fall out. It turns out they're very comfortable, virtually the same shape as the EarPods but with more heft. They perch right in my ear openings and stay put better than the EarPods or silicone-tipped earbuds.

The sound

I care more about comfort than sound because I'm not an audiophile. I listen to tons of music, and can tell good earphones from terrible ones, so Apple's bundled free EarPods suit me just fine for streaming music and podcasts. I used to rock a $130 pair of Bose MIE2i (go.pcworld.com/mie2i) in-ear phones (since discontinued) when my iPhones had jacks for them, and I expected the AirPods to fall somewhere in between these earphones and the EarPods. Well, I'm happy to report

the AirPods sound great—just as good as the Bose set, with full, detailed sound and plenty of volume.

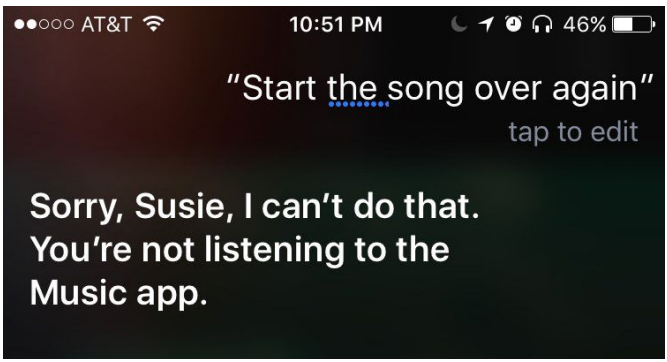
The AirPods sound better than the EarPods, but they have that same kind of fit, where the bud itself just rests in your ear opening, instead of going way down into your ear canal. And since they don't have a silicone or foam tip like the 'buds that get shoved more deeply into your ear, they don't seal off outside noise as fully. But their impressive volume quickly drowns out your surroundings. Once my iPhone is at about 60 percent volume, I can no longer hear myself speak at a normal volume while I'm wearing the AirPods.

The white stems that hang down from the AirPods hold the microphone, which you'll need for voice calls, and speaking with Siri. I used Siri to make a voice call both indoors and outdoors, and the people I chatted with reported a slight echo-y sound common to Bluetooth phone calls, but only when I really pressed them to evaluate my sound. All in all, the sound was good enough for calls.

The controls

Speaking to Siri, though, somewhat mars the AirPods experience. To

turn up the volume with the free EarPods, you simply click a button on the inline remote. With the AirPods, however, you have to double-tap one AirPod, wait for your music to pause and the Siri chime to sound, and say "Turn it up" (or, even better, "Turn up the volume," just to make sure Siri will understand). Then you wait another couple of beats for your music to resume, now two notches louder. If you say, "Turn it up to 50 percent," the volume still gets turned up two notches louder. It's an annoying process, so you're better off using the volume controls on your phone—if your phone is within arm's reach.



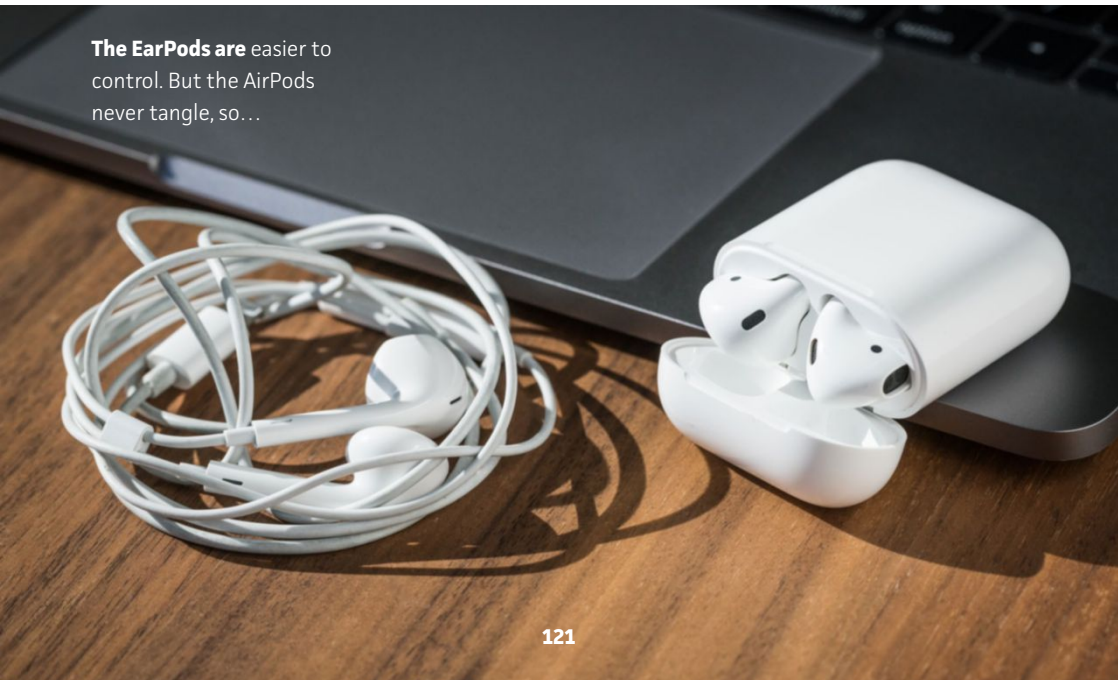
In this case, "Go back a track" would start the current song over, but who wants to engage in trial-and-error with laggy Siri when you used to have a button for this?

Siri can also control Apple Music and your own music collection stored in Apple's Music app. But Apple chose not to give full Siri control to third-party music apps, and that's a huge bummer when you try to use earbuds that require the use of Siri. In Spotify, I could turn the volume up and down, and skip to the next track. But to start a song over (three clicks on the EarPods remote, thank you very much), I couldn't say, "Start this song over," though "Go back one track" was more responsive. And, obviously, I couldn't call up specific artists, albums, playlists, and songs. The AirPods are at their best when you are all-in with Apple devices and services. If you're a die-hard user of Spotify or Pandora, these might not be the headphones for you.

But either way, Siri is just too slow and buggy to be a rock-solid control set. I quickly found myself wanting to just use the controls on the iPhone itself. As a side note, I've never appreciated iOS 10's Raise To Wake feature so much until I got my AirPods, since I can bring up the lock screen play/pause, forward, and rewind buttons so easily, and leave Siri out of it.

You can also go into Settings > Bluetooth, hit the little i button next to your AirPods, and change the double-tap gesture to Play/Pause or Off. A second gesture would still be helpful. I'd love an experimental mode that apes the click patterns on the EarPods remote (single to play/pause, double to advance a track, triple to back up).

The auto-pause feature does work well, and mostly seamlessly across apps. When you are listening to the AirPods, and you take one out of your ear, the sound pauses. When you put it back in your ear, it starts playing again. While the feature is mostly solid, it isn't a sure thing. A few times the music would start playing again after I'd stuck one AirPod in my jacket pocket while talking to a cashier. Other times, taking an AirPod out would pause a podcast in Pocket Casts, but putting it back in wouldn't start it playing again. Instead, I had to hit Play on the iPhone itself. If you do want to play music on only one AirPod for some reason, you can just press Play on the iPhone after taking one out.



The EarPods are easier to control. But the AirPods never tangle, so…

A little LED inside the case glows green when the AirPods are mostly charged, orange when they need charge. A more accurate meter is on the iPhone.

Even with a little finicky behavior, I love this feature. I'm also testing a pair of Libratone wireless headphones right now, and they have a feature where you can mute the sound by cupping your hand over one ear. I'm glad companies are thinking about easy ways to silence the sound so you can say hi to neighbors or conduct a transaction politely. But pausing is better than muting, especially for podcast fans, so AirPods have the edge there.

The little things

Because Apple makes these, the AirPods are locked in to iOS 10 like no other headphones will ever be. You can check the battery life in the Battery widget in Notification Center. Even just opening the charging case with the AirPods inside will pop up a notification on your phone showing the charge level of your AirPods (left and right batteries—strangely, they don't wear down at exactly the same level) and the case.

The charging case is brilliant. It's small and white and easy to stash in a pocket or bag. It kind of looks like a fancy package of dental floss, with a top that flips open and shut with a tight magnetic click. The

This button lets you pair to a non-Apple device, if you must.

AirPods charge inside this case, so if you keep them there when they're not in your ears, and then remember to charge the case now and then, keeping the AirPods charged isn't too much of a burden. The case itself charges via a Lightning port, so I just try to remember to top it off while I'm using the AirPods at my desk.

In my tests, the AirPods easily get Apple's stated 5 hours of music time per charge. I'm at 5 hours on my stopwatch right now, in fact, and the AirPods have 12 percent charge left according to the Battery widget in iOS 10. Apple says the case should have about 24 hours of battery life in it, and just 15 minutes in the case can power your AirPods for three more hours (it got me from 4 percent to 79). The AirPods make a sad little sound when they reach 10 percent so you'll know they're almost out of juice.

Connecting the AirPods to an iPhone for the first time is as easy as opening the case. A message pops up on the iPhone offering to connect, and when you do, the AirPods also appear in the Bluetooth menu of any Macs (running macOS Sierra) you use with the same

iCloud account. Switching to an iPad and Apple Watch with the same iCloud account is similarly easy, and you don't have to trick your iPhone into unpairing with the AirPods to listen to them on a different device. They're always paired to everything, and you can just select AirPods on that thing and press play.

The back of the charging case has a round white button that's barely visible. With the AirPods in the open case, you can press and hold that button to turn a tiny LED in the case white. That means they're in pairing mode, and you can pair them to an Android phone or another Bluetooth device, but without Siri or the extra features. I haven't experimented with that for this review, but we'll do a follow-up soon.

Bottom line

The three-button remote on wired earbuds is a much faster, easier way to control your music than double-tapping one ear and then trying to get Siri to do what you want. But I can't help liking the AirPods—the cool design and powerful sound just keep me coming back. I just wish they had another gesture, or smarter/faster Siri, to be as convenient as what they're replacing.

Take time to be a dad today.

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National Responsible Fatherhood Clearinghouse

Ad Council


POLAR
OPPOSITES
Protect the Arctic's Future | wwf.org

THE WILD, WEIRD, AND POWERFUL PC HARDWARE of CES 2017

BY JON PHILLIPS

DON'T BE SCARED. **IT'S JUST KICK-ASS GEAR.**

Forget the smart hairbrush. Disregard the vaporous electric car (go.pcworld.com/vapecar). You can even walk past the latest TVs (though I have to concede, some are supercool). Like the last few Consumer Electronic Shows, CES 2017 has emerged as a fantastic pantheon of PC hardware—from the latest cutting-edge silicon, to wild laptops, to outrageous desktop machines and cases. Here, you can see the gear that *PCWorld*'s CES foot soldiers found most intriguing.

RAZER'S **PROJECT VALERIE** IS A TRIPLE-DISPLAY, 12K LAPTOP

This blurb can't do Project Valerie justice. You must watch the spectacular video (go.pcworld.com/projectvalerie) of Razer's fan-bloody-amazing laptop, which features three 17-inch 4K G-Sync displays, two of which automatically slide out from the main display with the help of robot arms.

Project Valerie is still just a project—an R&D prototype that may never ship. And maybe you wouldn't actually want it. With about 370 square inches of display pixels to power, imagine the machine's brief battery life. Also consider the price, which would likely hit at least $5,000. And what happens when you automatically extend those displays in a small, cramped space? Do they just snap off?

But, hey, whatever. It's prototypes like Project Valerie that make CES exciting. This is why we come.

PROJECT ARIANA: A 4K RAZER PROJECTOR THAT EXTENDS FROM MONITOR TO WALLS

Razer wasn't done after wowing us with Project Valerie. This is project Ariana, a 4K projector that extends the image on your display to your entire wall, creating a spectacular immersive effect. You can read all about Project Ariana (go.pcworld.com/projectariana), and pay close attention, because the projector could go retail by the end of 2017 if Razer is convinced consumers are ready to buy in.

PROJECT MODENA IS THE SUM TOTAL OF DIGITAL STORM'S HARDCORE KNOWLEDGE

Digital Storm has a rich history in building luscious, water-cooled boutique PCs, and in its not-yet-for-retail Project Modena prototype (go.pcworld.com/prjmodena), it pulls out all the stops. You can think of it as the living embodiment of all the company's PC knowledge (assuming, of course, you believe a PC can be "alive"). The machine sports aggressive vents running on the front, top, and back of the case, allowing for a range of cooling approaches. And in this photo you can see the mobo-facing case panel, revealing interior lighting and the water-cooling apparatus, all tastefully executed. There's also a smaller case window on the other side for showing off your high-dollar SSD investment.

Project Modena wasn't the only Digital Storm PC we looked at, so please check them all out in our Best of Digital Storm video (go.pcworld.com/digstormces17).

SNOWBLIND IS A CASE THAT PLAYS TRANSLUCENT VIDEOS ON ITS SIDE WINDOW

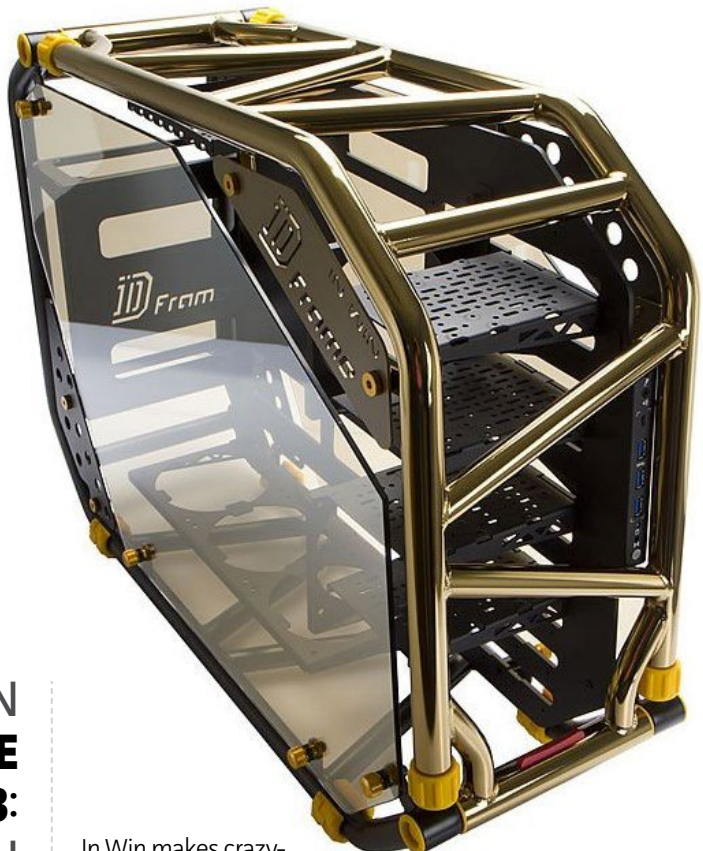
This is another CES oddity that can't be adequately illustrated by flat images, so check out the video (go.pcworld.com/snwblndpcase), please. iBuypower's Snowblind case option is a 19-inch transparent LCD that can show moving images—video—right on the side of your PC. Resolution is 1280x1024, and the display itself is protected by tempered glass. The image here doesn't do the mesmerizing video effect justice, but note the CPU utilization widget on the right of the display—that's live, real-time-updating content.

Snowblind is one of the coolest spectacles we saw at CES 2017, and iBuypower says this case option will cost $250.

ACER'S **PREDATOR 21 X** HAS A WILD CURVED DISPLAY

If you want to join Acer's extreme gaming laptop party, you'll need $9,000. But, whoa, look what you get inside the Predator 21 X: Intel's Kaby Lake Core i7 7820HK; 64GB of 2.4GHz DDR4 RAM; not one but two GeForce GTX 1080s running in SLI; and up to four SSDs running in RAID 0 (plus a hard drive if you want one). There's also a mechanical Cherry MX keyboard, Tobii eye-tracking, and tons of fans and heat pipes, because, Captain, she's running hot.

But, obviously, the big allure of the Predator 21 X—the feature that makes it a CES freak show—is the curved, 21-inch IPS display, the first of its kind in a laptop. It runs at 120Hz and supports Nvidia's G-Sync tech, and could make your gaming more immersive (or at least that's the Acer storyline). Please check out the video (go.pcworld.com/pred21xho) to see the entire 8.8 pounds of madness.



IN WIN **D-FRAME 2.0 EKWB**: A TOUCH INDELICATE?

In Win makes crazy-hardcore cases for PC enthusiasts who just have to have something, well, showy. Interested? Then you need to see our video (go.pcworld.com/inwinces17) of the D-Frame 2.0 EKWB, which adds special mounting points for liquid-cooling like EK's Water Blocks. Please watch the video, and pay special attention to the burbling reservoir at the front of the case.

EVGA'S **SC-15** IS A GAMING LAPTOP THAT MAKES SENSE

You don't really need the 4K display in EVGA's SC-17 gaming laptop, so at this year's CES, the company released the SC-15 (go.pcworld.com/evgasc15ces), a 15-inch predecessor that boasts a 1080p, 120Hz G-Sync panel. It looks gorgeous, and is ably powered by Nvidia's mobile GTX 1060 chip. Other silicon includes a Kaby Lake Core i7-7700HQ processor, up to 16GB of DDR4, and a 256GB SSD paired with a 1TB hard drive.

And of course there's an RGB backlit keyboard too. It's a gaming machine.

EVGA DOES **WATER-COOLING** TOO

Remember when EVGA was just a video card company? Well, besides getting into cases, power supplies, mice, motherboards, and full-fledged PCs, the company is now selling a trick water-cooling system that marries the simplicity of closed-loop water-cooling with the customization of hard-line water-cooling.

The EVGA Quick Release (go.pcworld.com/evgaqikr) cooler ecosystem starts with the main CPU cooler shown here, and then you customize to your heart's content with apparatus that suits your specific parts. From radiators to a GPU cooler to various extension cables, they all use special quick-release fittings so you can construct your setup, like building with an erector set.

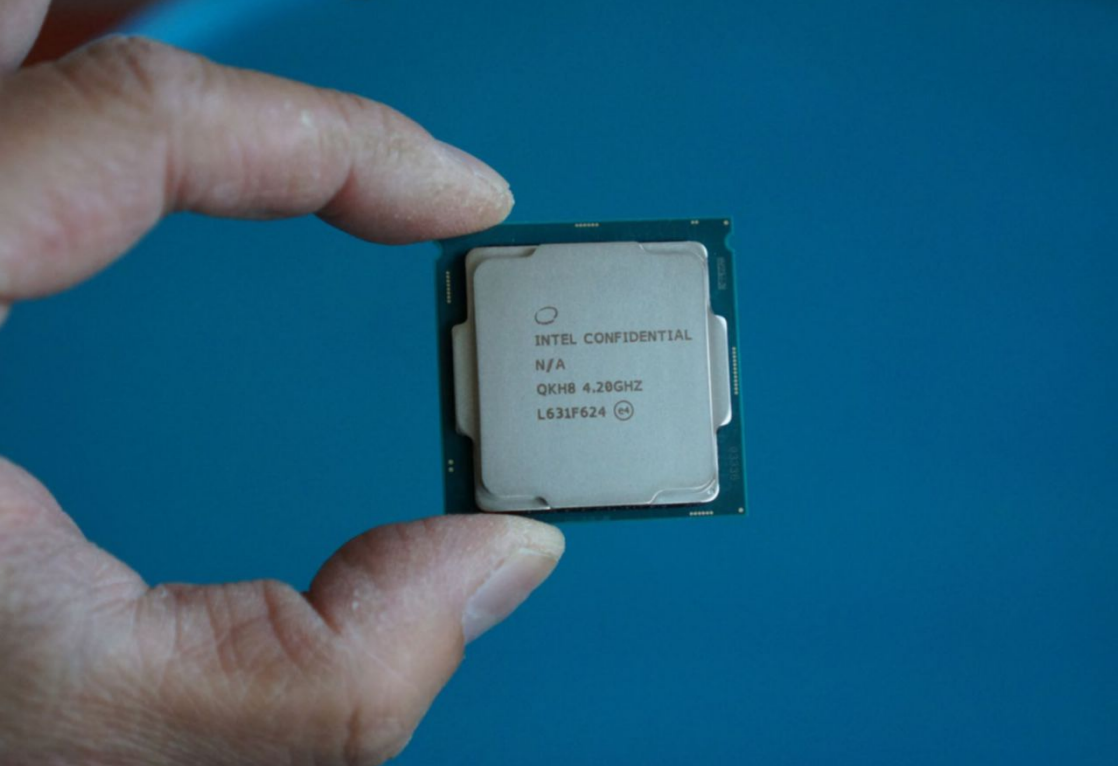
AMD **VEGA**: THE FUTURE OF GAMING GRAPHICS?

AMD's more enthusiast-focused 14nm Radeon graphics architecture has been teased on the company's roadmap for a while, but AMD used this year's CES to release more technical details on these upcoming Vega GPUs.

If you want to learn more about Vega's high-bandwidth cache, programmable geometry pipeline, and "draw stream binning rasterizer" (yes, it's a thing), then go.pcworld.com/radvega5. For now, all you really need to care about is the new GPU's performance potential, and how that may affect your gaming experience.

To wit: In December, we saw an early Radeon Vega 10 card play the 2016 version of Doom at 4K resolution and settings cranked to Ultra. AMD's frame rates floated between 60 and 70 fps, thus beating recorded frame rates for Nvidia's GTX 1080 at the same settings.

Intrigued? Well, we may not see shipping Vega hardware until this summer. Still, CES definitely whetted our Vega appetite. If you're interested in even more nitty-gritty details, be sure to watch the 40-minute deep dive interview (go.pcworld.com/fullnerdkoduri) that our Full Nerd podcast crew conducted with Radeon SVP and chief architect Raja Koduri at CES.



INTEL **KABY LAKE**: NEW QUAD-CORE CPUS HIT 5GHZ

We first saw dual-core Kaby Lake notebook CPUs in August (go.pcworld.com/kaby4kvid), but now it's time for quad-core processors—seven chips for laptops and 16 for desktops. They're all part of Intel's CES Kaby Lake party, and while performance increases in many scenarios aren't incredible relative to previous-generation silicon, the new architecture is still intriguing.

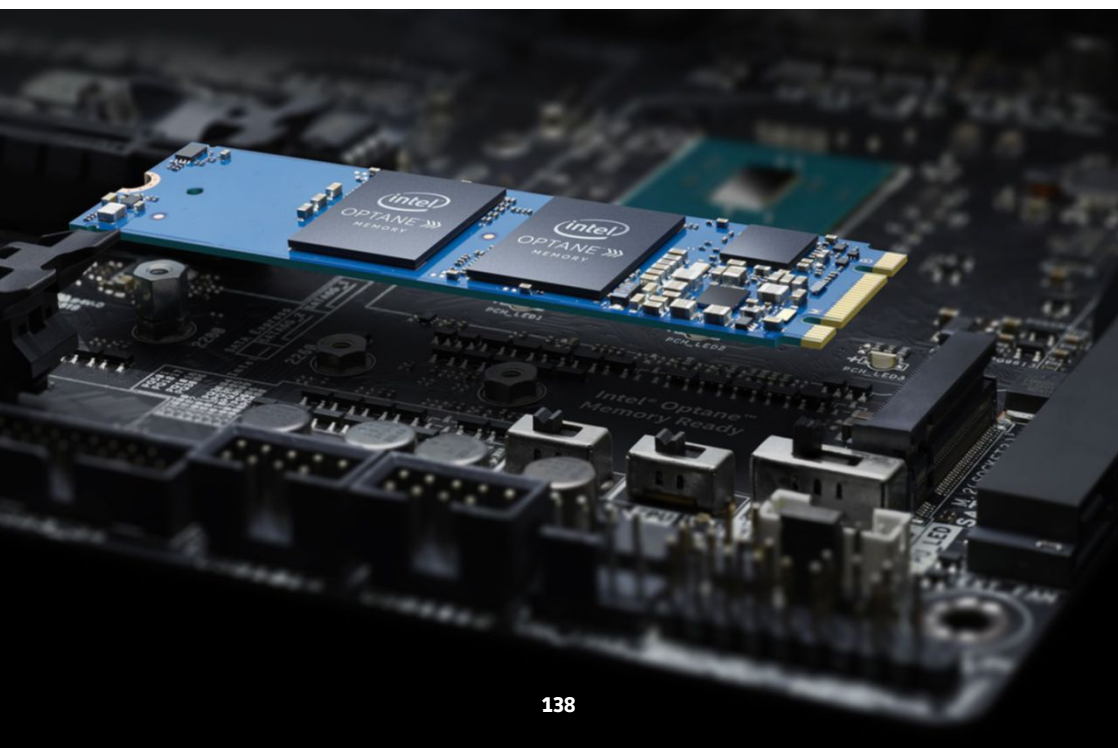
For starters, while cache size, the memory controller, and motherboard socket haven't changed since previous-generation Skylake chips, the Kaby Lake desktop CPUs seem ripe for overclocking (despite early reports). Both *PCWorld* and various OEMs have seen the quad-core chip reach the vaunted 5GHz barrier without any problems. The Kaby Lake Z270 chipset is also "Optane-ready," suggesting motherboards will support Intel's superfast memory of the same name.

Though we do have Optane caveats. See the next page, please.

SPEAKING OF OPTANE...

Intel's Optane memory promises one thousand times the switching speed of an SSD, and to get PC nerds even more excited about the new format, Intel showed two images of its non-volatile memory drives on the eve of CES. We have no idea how much the drives will cost, or when they'll be available, but expect almost unusable small drive capacities of 16GB and 32GB. At these sizes, they have little application save as hard-drive cache.

But, hey, we now have pictures (go.pcworld.com/optaneces17)! Thanks, CES.



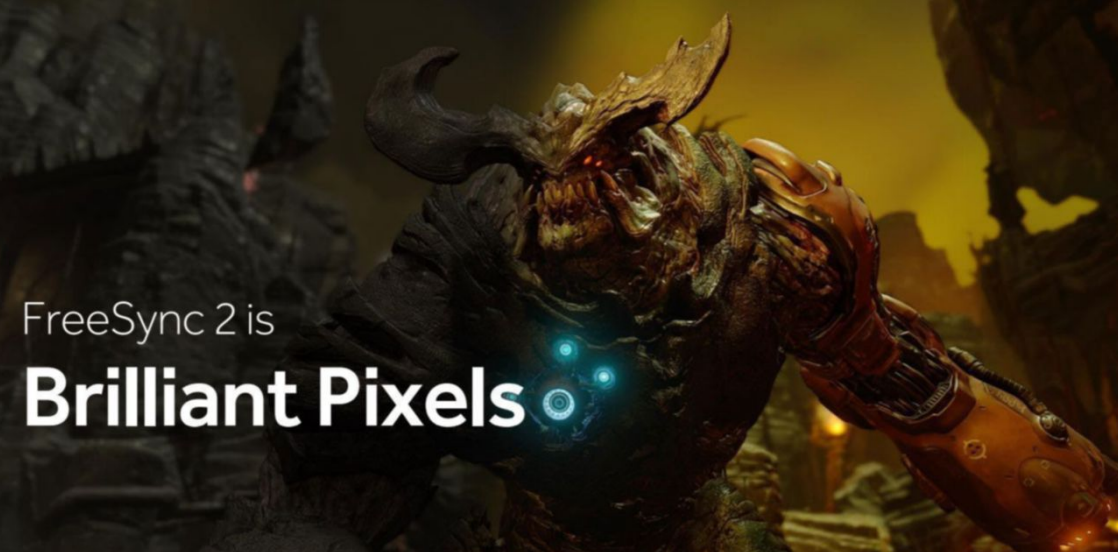
RYZEN RISING

Perhaps you haven't heard, but AMD's new Ryzen CPU (originally code-named Zen) looks to be quite competitive with Intel silicon. The processor is set for a Q1 2017 launch, and AMD and its partners used CES as a grand coming-out party (go.pcworld.com/ryzenpcs) for Ryzen hardware—from AM4 motherboards to CPU coolers to full-fledged PCs (like the Cybertron PC shown here). The system manufacturers definitely err toward smaller, enthusiast-focused vendors like Origin, CyberPower, Maingear, and iBuyPower. But that's encouraging, as it suggests Ryzen will bring the metal on judgment day.

INTEL SHOWS OFF THE 10NM CANNON LAKE CPU

OK, well maybe "shows off" is an optimistic way to describe Intel's demonstration of its sometime-in-the-future 10nm process CPU. As you can see here, Intel's chief executive Brian Krzanich simply used the big stage of CES to show the processor (go.pcworld.com/cannonlakedemo) playing back a video. We didn't actually see the chip—let alone touch the laptop that presumably contained the chip.

But still…it's got a 10nm process! Intel has been stuck on a 14nm process for a few CPU generations, and AMD will finally be joining the 14nm club when it goes retail with Ryzen this year. So, yeah, call us nerds, but even a 10nm tease is something to be excited about.



AMD **FREESYNC 2** FOR HDR DISPLAY AWESOMENESS

AMD used CES to reveal details on the latest iteration of its FreeSync graphics technology. Where today's FreeSync simply smooths out gameplay and eliminates stutter and tearing, FreeSync 2 is focused squarely on HDR displays—those High Dynamic Range monitors that make supported content look lush with saturated colors, deep blacks, and stunning contrast.

We have all the technical details on FreeSync 2 (go.pcworld.com/freesync2ces17), but just know that you'll need a display that meets FreeSync 2 certification (these monitors should hit retail in Q1 of this year). We also learned that any GPU that currently supports FreeSync can be upgraded to FreeSync 2 via a driver update. Both FreeSync and FreeSync 2 will be supported going forward, with FreeSync 2 monitors expected to be just a small percentage of the total number of FreeSync displays shipped.

Have you seen HDR content? You'll want this support, whether you rock an AMD or Nvidia graphics card. CES was ground zero for a bunch of HDR PC display launches (go.pcworld.com/freesync2ces17), so please get up to speed. This is important.

NVIDIA **G-SYNC HDR DISPLAYS** DESCEND ON CES

While we've yet to see any displays that guarantee support for FreeSync 2 (AMD's HDR tech), we did see Nvidia's debut G-Sync HDR monitors (go.pcworld.com/gsynchdrces17)—and they look like the pinnacle of desktop displayage.

Keep your eyes peeled for the Acer Predator XB272-HDR and Asus ROG Swift PG27UQ. They're both G-Sync HDR 10 panels that shine at 1,000 nits of brightness, hit 144Hz, and deliver 384 backlight zones that can be individually controlled to help lush colors and deep blacks coexist side-by-side (that's basically the HDR promise). As if those HDR features weren't enough, they also rock 4K resolutions and blazing-fast 144Hz refresh speeds. No word on pricing, but expect to pay top dollar for what will certainly be the finest desktop displays you can buy.

Need an HDR display primer? go.pcworld.com/gsynchdrces17. Want to see that awesome Asus display in action? go.pcworld.com/asus4khdres17.

THE LINKSYS **WRT32X** IS A HARDCORE GAMING ROUTER

Every modern Wi-Fi router has some type of quality-of-service (QoS) feature that assigns different priorities to different types of Internet traffic. But Linksys says the WRT32X (go.pcworld.com/wrt32xces17)—a 802.11n/802.11ac MU-MIMO router—is highly optimized to recognize lag-sensitive traffic like games. The secret sauce is Rivet Networks' "Killer Prioritization Engine."

Rivet Networks told us the technology uses heuristic logic to determine which network traffic is gaming traffic, and then assigns that data the highest priority. As the company's marketing officer, Bob Grim, said, "A Microsoft Windows update packet shouldn't be treated as just as important as a gaming packet. We'll never queue a gaming packet, for example, because it's latency dependent."

Of course, it doesn't hurt that the WRT32X looks all gamered-out. Even router companies want in on CES' PC-enthusiast action.

LENOVO LAUNCHES **LEGION**, ITS GAMING LAPTOP BRAND

Yes, Lenovo—the enterprise laptop company—makes good gaming machines, and now it's putting these laptops under their own unique brand name, Legion (go.pcworld.com/legionces17). Here we see the RGB backlighting underneath the Legion Y720's keyboard.

The Y720 includes a Kaby Lake Core i7 and 16GB of DDR4 memory, and can be outfitted with a 512GB SSD and 6GB Nvidia GTX 1060, making the machine capable of powering a VR headset. There's also a 4K screen option, and even the baseline display is IPS, addressing a complaint we had with Lenovo's Y50 gaming machine from 2015.

HP UPGRADES ITS **SPROUT CREATIVITY PC** FOR A VR AND AR WORLD

Hardcore PC hardware isn't just about gaming, so HP used CES 2017 to reveal its upgraded Sprout Pro (go.pcworld.com/sproutproces17) workstation. And thanks to the Windows 10 Creators Update, HP's Sprout platform should be more friendly to 3D content creation than ever before.

The machine uses a Full-HD DLP projector and what HP calls a Touch Mat to quickly turn any small object—like the skull model shown here—into a 3D wireframe. The benefits for VR and AR content creation should be obvious.

The upgraded Sprout Pro sports a 2.9GHz Kaby Lake Core i7-7700T and Nvidia's GeForce GTX 960M with 2GB of GDDR5 memory. The main display is 23.8 inches with a 1920x1080 resolution and 10-point touch. Interested in making a HoloLens app? Well, the Sprout Pro should ship in March. Pricing is unknown, but the original Sprout costs $1,600.

KINGSTON'S **2TB DATATRAVELER** NEEDS NO EXPLANATION

Two terabytes. In a flash drive. That you can put in your pocket.

OK, you'll need a very large pocket, because as Kingston's image illustrates, the drive itself dwarves its USB 3.1 connector. But, c'mon. Bragging rights!

We have no idea how much the DataTraveler Ultimate Generation Terabyte (go.pcworld.com/dtrvlrces17) will cost, but we do know that it will come in 1TB and 2TB configurations, and that Kingston's current 1TB DataTraveler HyperX Predator costs $2,730.

So, what? The new 2TB version will cost twice that?

PHANTEKS'S **ENTHOO ELITE CASE** IS SO BIG, WE COULDN'T FIT IT IN THE FRAME

With enough interior room for not one but two PC builds, the $900 Enthoo Elite is a case of absurd proportions. At 30 inches tall and two feet wide, the enclosure can accommodate one E-ATX system plus a mini-ITX system. The case is rife with interesting detailed design to make system building easier, so please check out the video (go.pcworld.com/enthooces17). Like the image shown here, you'll see we struggled to fit the Enthoo Elite into a single video frame.

THERMALTAKE'S **CORE P1 TG** WANTS ON YOUR WALL

Why would you want to mount a PC on your wall? We can't tell you. But ThermalTake thinks there's a wall PC market, and thus we have the Core P1 TG (go.pcworld.com/corep1tgces17), an open-air case that supports Mini ITX motherboards, and can be mounted on your wall. A flexible PCIe riser cable lets you mount your video card perpendicular to the motherboard, and a piece of tempered glass prevents flying objects from disturbing your water-cooling apparatus.

Is it art? It's better than a Thomas Kinkade painting, that's for sure.

HWBOT'S **EXTREME OVERCLOCKING** CHALLENGE

Think those new Kaby Lake desktop CPUs resist overclocking? No. Think again. Industry sources tell us the chip is happy to reach 5GHz with water-cooling, and at the warm-up for HWbot's extreme overclocking event (go.pcworld.com/hwbotevent), we saw 7GHz. WTF? Yes.

Granted, the overclocking superstars at this CES event were using liquid nitrogen to cool down the silicon and ratchet up the clocks. But one still has to marvel at just how far these PCs can be pushed. Be sure to read up on all our CES 2017 coverage (pcworld.com/tag/ces-2017).

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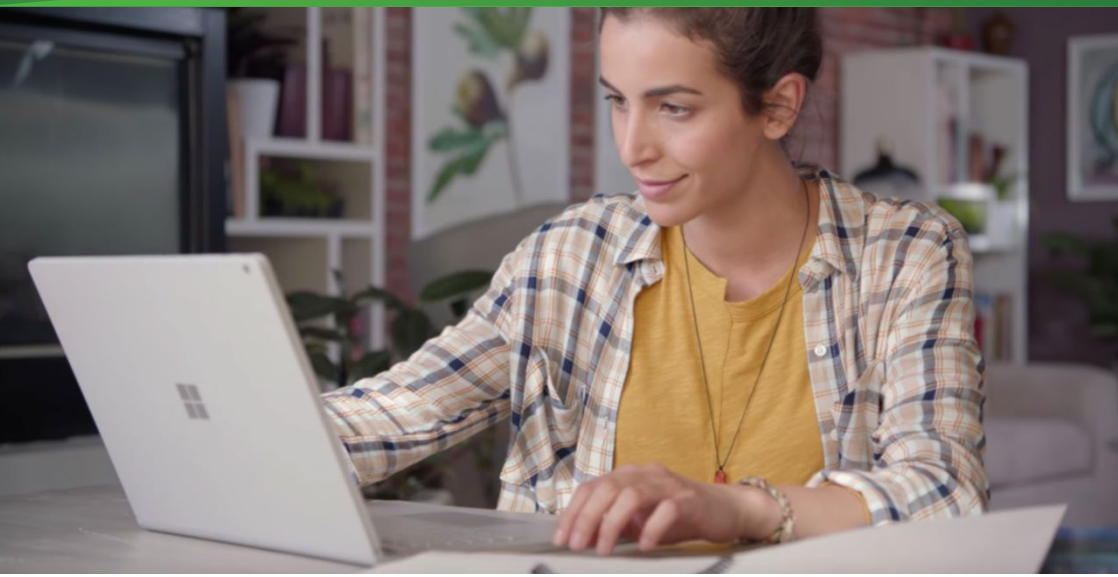
The Windows 10 CREATORS UPDATE'S BEST NEW FEATURES:

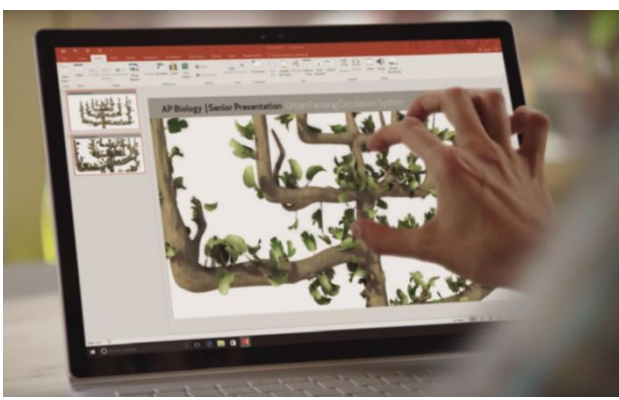
Dynamic Lock, Game Mode, privacy tweaks

+ more

BY BRAD CHACOS



A taste of what's to come



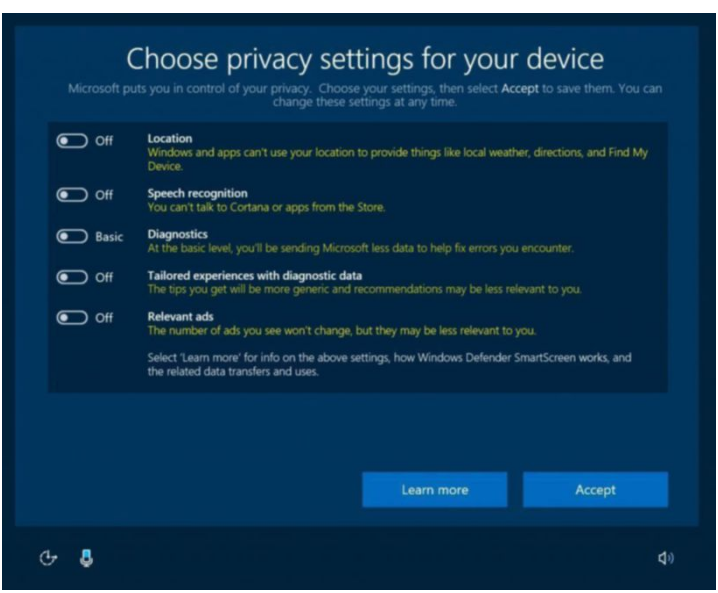
Windows 10 doesn't behave like the Windows of yesteryear. Instead of a monolithic operating system replaced by a successor in a year or two, it's more of a living, breathing entity—one that's constantly changing with the release of massive new "named" updates. The most high-profile example was 2016's Anniversary Update, which added features like the Bash Shell, a dark theme, Windows Ink, Xbox Play Anywhere, and a whole, whole lot more.

But that's *nothing* compared to what you'll find in this spring's Windows 10 Creators Update. Let's dig into the goodies Microsoft has planned this time around, and don't forget to sign up for the Windows Insider preview program (go.pcworld.com/w10insiderprvp) if you want to get your hands on early-access test builds before the clamoring masses.

Privacy dashboard

The launch of Windows 10 was marred by two major controversies: the heavy-handed, downright nasty forced-upgrade push, and deep-seated privacy concerns. Well, Microsoft's aggressive user migration ended when the free-upgrade offer expired, and the Windows 10 Creators Update addresses privacy concerns with a new privacy dashboard.

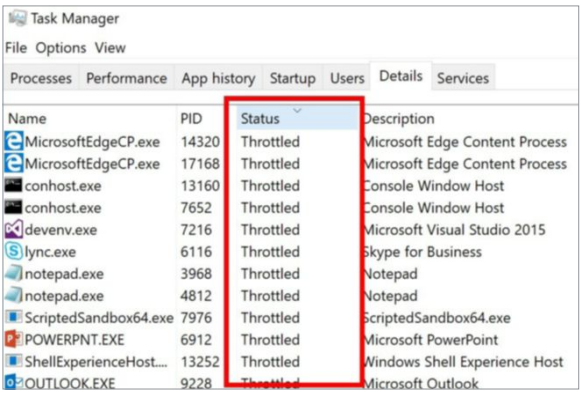
The good news: The simplified dashboard is easy to understand and manage. The bad news: It limits your options to allowing Microsoft minimal or "full" access to your PC, eliminating intermediate options that were there prior. Check out *PCWorld*'s Windows 10 privacy dashboard coverage (see page 36) for the full skinny.



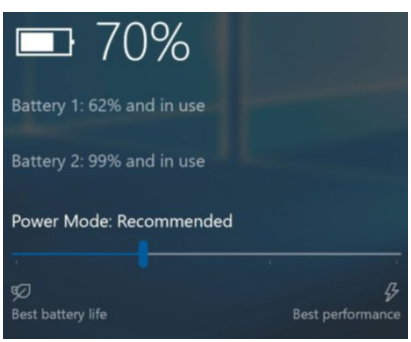
Gaming enhancements

Gamers will find a lot to love in the Creators Update—at least if they've learned to stop worrying and love the Windows Store. (If you're not playing the likes of *Minecraft*, *Forza Horizon 3*, or *Gears of War 4*, there's a lot less to be excited about.) Microsoft's baking the ability to stream your live gaming sessions (go.pcworld.com/xboxstreaming) to your Xbox Live buddies via Beam right into Windows 10's Game DVR tool, complete with chatting capabilities. If you're a parent, you'll no doubt appreciate what appears to be time-limit controls for games. Microsoft's only briefly teased the feature in a sizzle video, but presumably it would be managed via Windows 10's family settings. Finally, Windows 10 will also have a "gameplay mode" (go.pcworld.com/w10gpmode) that shifts resources around to maximize system performance when you need extra oomph.

App throttling



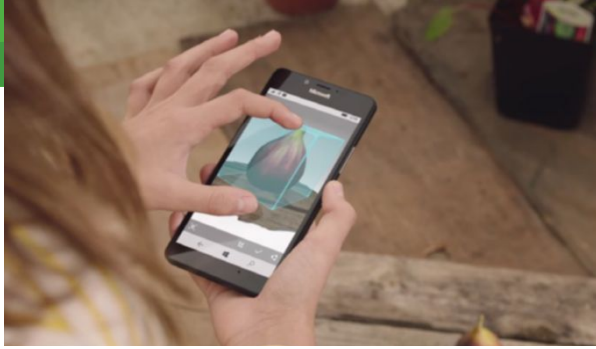
Something similar to Gameplay Mode may also be available for standard software as well. A small test group of Windows Insiders were given a version of preview Build 15002 that includes automatic app throttling, which dials back the resources allocated to background tasks if you need more firepower for your main focus. It's easy to see where that could come in handy for people running Windows 10 on more modest (or older) PCs.



Power mode slider

You'll also be able to adjust Window's 10 oomph on the fly with a new Power Mode slider coming to the battery section of the Windows taskbar in "select" devices. Crank it if you need more computing firepower, or dial it back if you don't mind giving up performance to increase your battery life.

"We'll be working with OEMs to determine the best settings for their customers, so that they can ship those on new Windows 10 PCs," Windows Insider chief Dona Sakar wrote in the blog post announcing the feature. Speaking of, Windows Insiders that see the new slider in early preview builds should note that it's not actually functional quite yet—Microsoft's just looking for interface feedback right now.



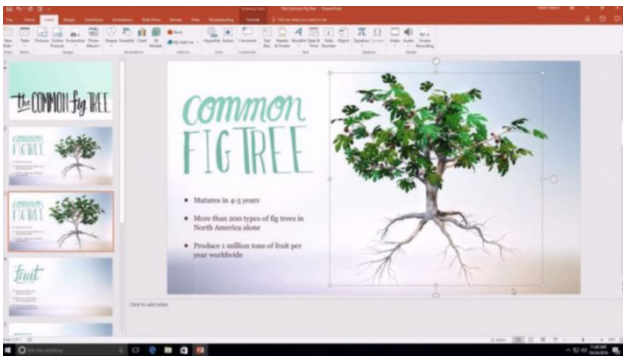
Windows Capture 3D

Three-dimensional imagery and virtual worlds are a big focus in the Windows 10 Creators Update. Windows Capture 3D for Windows 10 phones (and maybe tablets?) uses your device's camera to scan a physical object to create a 3D digital representation. Just point your camera at the object you'd like to digitize, then slowly move around it—similar to how you'd slowly scan an area to create a panoramic photo.

And then…

Paint 3D

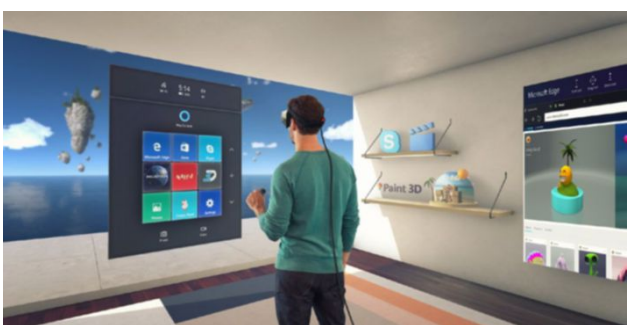
…you can drop your creations into the new Paint 3D app (go.pcworld.com/windows10paint3d), which supercharges the Paint we all know and love (okay, tolerate) with 3D image manipulation. Paint 3D's loaded with tools and filters that make 3D image manipulation easy-peasy, and it can even help you convert 2D images into 3D objects. Microsoft's updated app also hooks into Remix 3D (remix3d.com), a new website loaded with 3D images created by other Windows 10 users.



...even Office

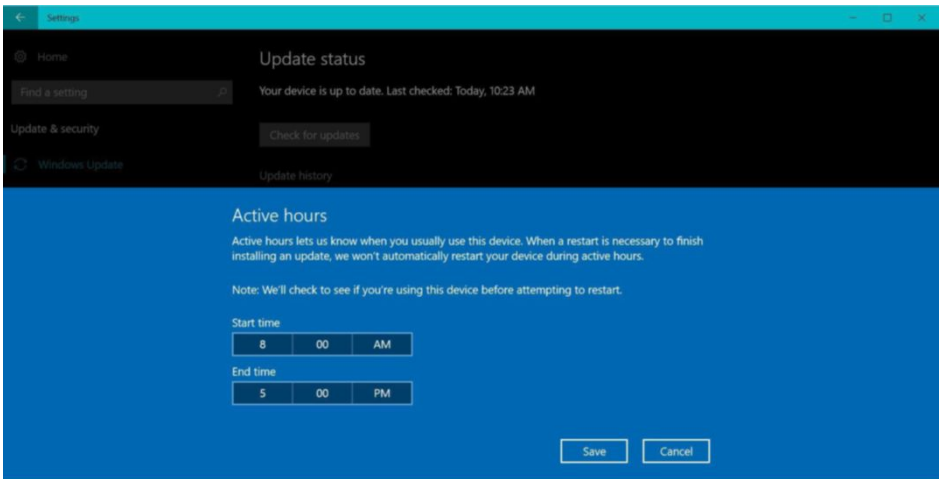
Microsoft's Office apps are being updated to support 3D imagery, too—or at least PowerPoint is, as Microsoft demonstrated at its Creators Update reveal. I'm assuming the rest of the suite will snag the same capabilities, but Microsoft hasn't confirmed that.

Windows VR



Along the same lines, the Windows 10 Creators Update includes the Windows 10 Holographic Shell. The Holographic shell adds support for augmented and virtual reality apps, so if you dropped $3,000 on a HoloLens developer kit (go.pcworld.com/hololensdevkit), it'll work with Windows out of the box.

But the Windows 10 Holographic Shell will open less princely VR avenues as well. A slew of Microsoft's hardware partners have Windows 10 VR headsets (go.pcworld.com/w10vrhdsets) ready to launch alongside the Creators Update, with prices starting at a mere $300—though you'll need to spend more for a headset that rivals the Oculus Rift or HTC Vive's capabilities.



Much-needed Windows Update improvements

The tweaks Microsoft introduced to Windows 10's updating system have bugged the hell out of many users, as there's no way to decline updates, and those forced updates have a nasty tendency of resetting your PC at inopportune times. The Creators Update adds two new features to make updates more tolerable.

First, Windows 10 Professional, Education, and Enterprise users will be able to defer new updates (go.pcworld.com/w10uup) for up to 35 days, as well as decide whether they want to include driver updates in the downloads. (Sorry Windows Home users, you're still the update guinea pigs.) Just as welcome, you'll be able to set your Active Hours—a defined time frame when Windows won't install updates—as an 18 hour window, rather than the 12 hour window supported today.

Finally, the Creators Update shifts to Microsoft's new Universal Update Platform, a set of behind-the-scenes changes in Windows 10 that reduce the processing power needed to update, shrink the size of update files, and streamline updates.

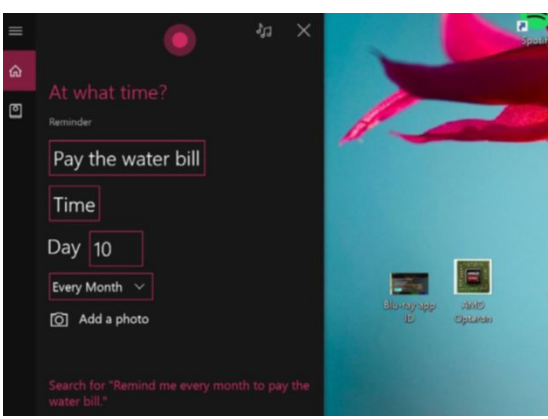
Dynamic Lock

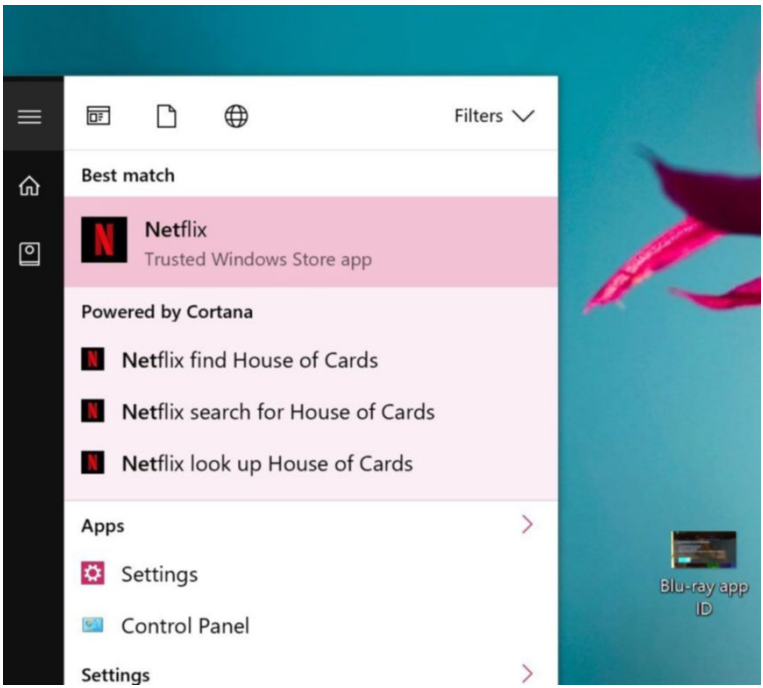
Windows Hello uses biometric sensors such as Intel's RealSense cameras to automatically log you in to your PC as you sit at it. Hints of a new Dynamic Lock feature—said to be called "Windows Goodbye" within Microsoft—in a Windows preview build suggest the Creators Update will also do the opposite and automatically lock your PC when you walk away.

Details are scarce right now, but this could be a major security boon for business users that need to protect their secrets from prying eyes. Adios, Win-L.

Cortana monthly reminders

Cortana's getting all sorts of helpful new features in the Creators Update. One of the tiny quality-of-life upgrades that might help hardcore Cortana users most? The newfound ability to schedule recurring monthly reminders.





The flood

One of the trickiest parts of Cortana is figuring out what she's capable of doing. The Windows 10 Creators Update tackles that problem by auto-suggesting commands based on what you're typing, as shown above. Great!

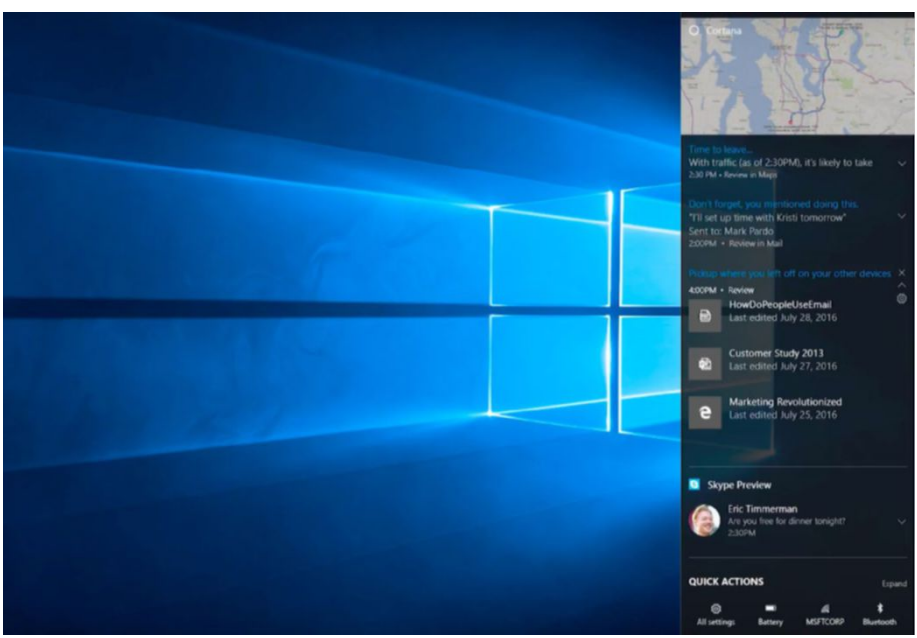
The digital assistant's snagging some other tweaks as well. You'll summon Cortana with Win-C rather than Win-Shift-C now, and she's picking up her own Start menu tile. Microsoft's also intertwining Cortana with the initial Windows 10 setup so users can ask the assistant questions to help configure devices, and enhancing Cortana's capabilities on the lock screen and managing music playback.

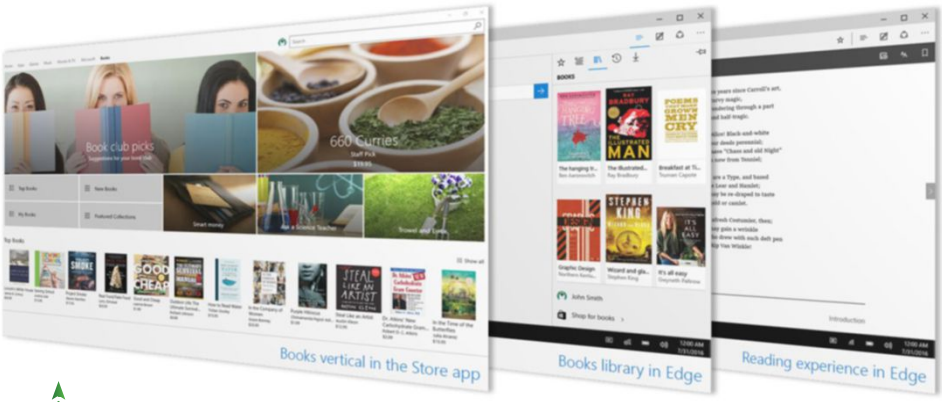
Jump from device to device

One of the Apple ecosystem's strongest benefits is Continuity, a feature that lets you pick up where you left off with files on other Apple devices. Now Microsoft's ecosystem is embracing the same "one file, any device" functionality thanks to a marriage between Cortana and the Action Center (aka Windows 10's notification center).

When you switch computers, the Action Center will now list quick links to any websites you were browsing in Edge on other PCs, along with links to any cloud-based documents you were working on. See it in action in the Action Bar in the image here.

Don't be surprised if this handoff feature only supports OneDrive- and Sharepoint-stored files out of the gate, but it's probably the feature I'm personally looking forward to most. Fingers crossed it expands to mobile devices that have the Cortana app installed before long.



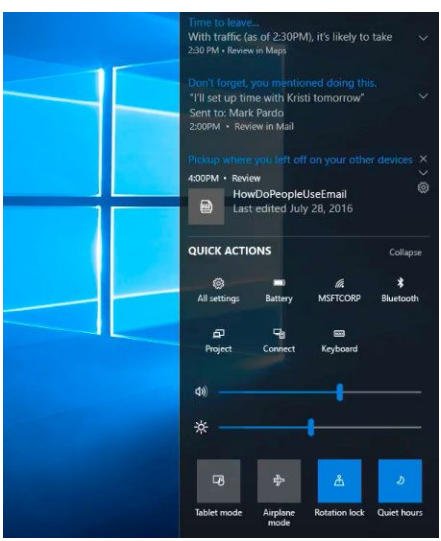


Ebooks!

The Windows Store's getting an ebook section in the Creators Update. You'll actually read the books in Windows 10's Edge browser, however, which is also picking up a dedicated Books section and the ability to read ebook file formats like ePUB. Bookmarks, variable font sizes, and Cortana-assisted word lookups are all supported.

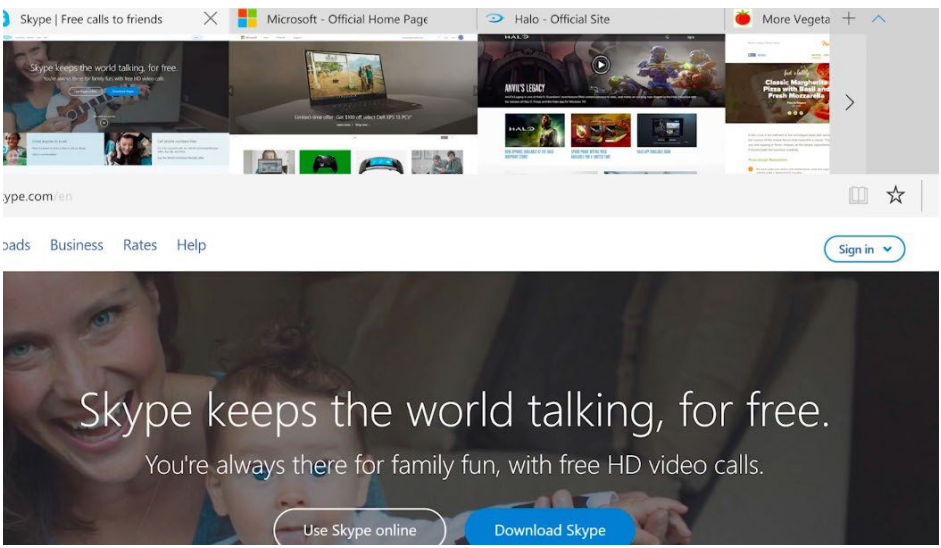
Revamped Quick Actions

Microsoft's reimagining the Action Center's Quick Actions as well. Currently, Quick Actions simply allow quick on-off access to specific functions, like Wi-Fi or projecting your display to other devices. But a brief splash in a Creators Update highlight reel shows fresh tools for adjusting variable options like screen brightness and audio volume via sliders.



Edge tab preview bar

That's far from the only update coming to Edge in the Creators Update. Clicking a new chevron located to the right of your tabs in-browser will pop open a bar containing rich visual previews of each tab. You can scroll through them all with a touch, a touchpad, or your mouse.

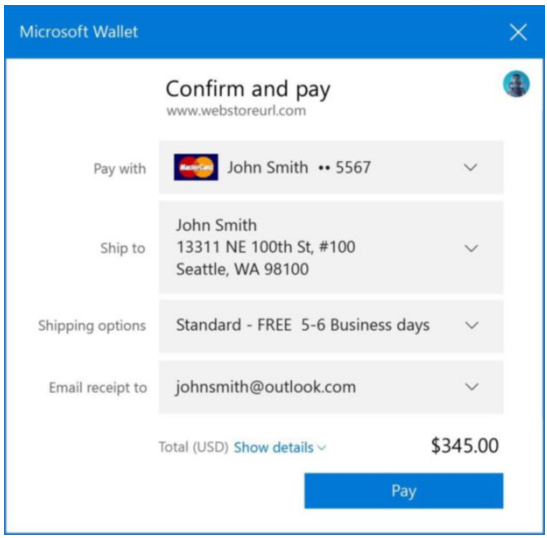


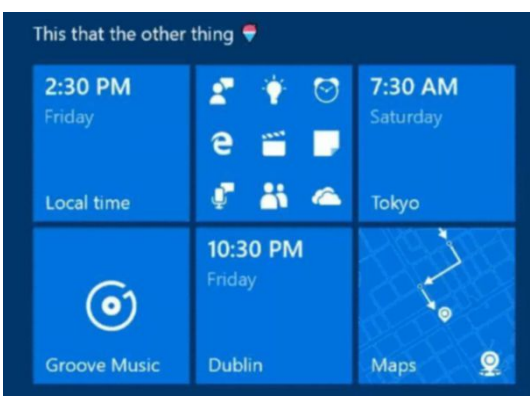
Life on the Edge

That's not the only Edge improvement. A new "set aside tabs" feature (pictured) lets the browser stash all your open tabs for recollecting later, assisting with tab management. Microsoft's browser can also make Flash content click-to-run, launch InPrivate windows straight from Edge's jump list in the task bar, and act as "a portal for interacting with 3D digital content" while you're wearing a HoloLens headset.

Microsoft Wallet in Edge

The Creators Update adds Edge browser support for the Payment Request API, which stores your payment and shipping preferences in your Microsoft Wallet, making online purchases fast and easy. It's a great addition to Edge and a fine expansion for Wallet, though you have to wonder why it wasn't implemented from the get-go.

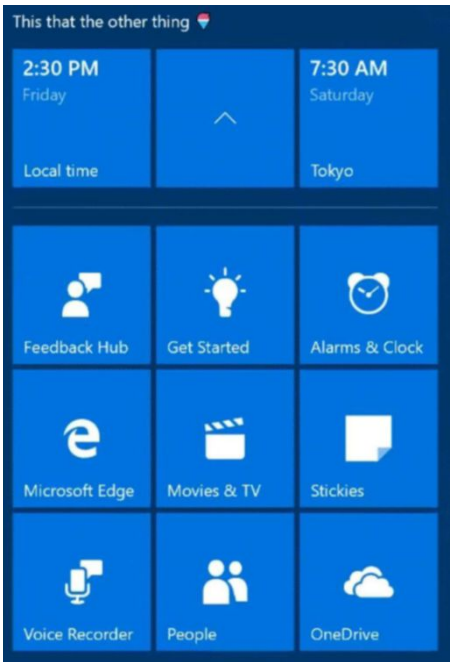




Start menu folders

Now this might wind up being handy. With the Windows 10 Creators Update, you'll be able to drag your Start menu apps on top of each other to create folders that expand when clicked on, just like in Windows 10 Mobile.

See the icon-packed tile in the middle of the upper row in this picture? That's a folder.



Start menu folders, expanded

And here's what the aforementioned Start menu folder expands to when clicked or tapped.

New Display settings

PC enthusiasts will find a lot to like in the Windows 10 Creators Update's various settings. The revamped Display options now hold the ability to adjust your screen resolution and adjust the amount of blue light emanating from your screen at night, like the beloved f.lux app (justgetflux.com).

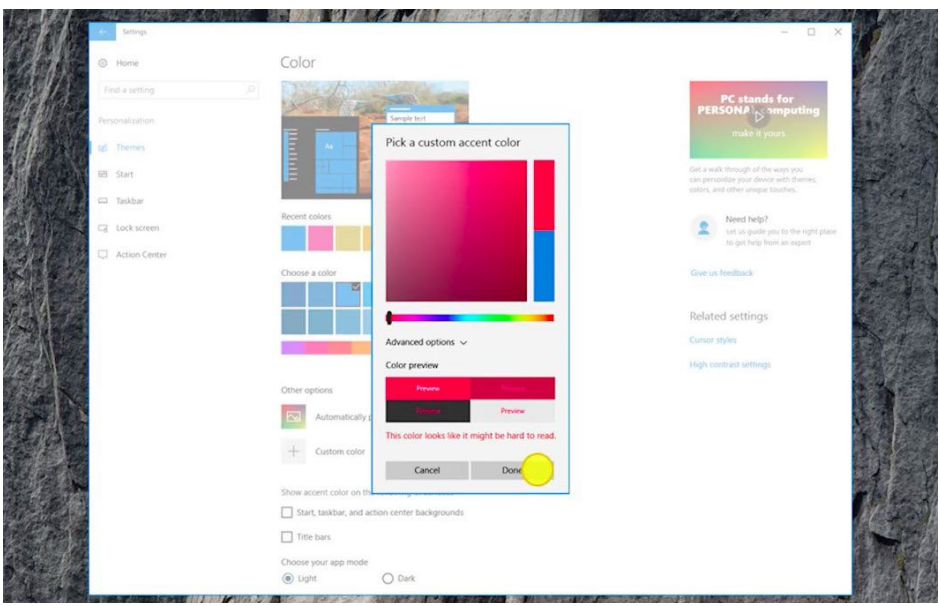
Touchpad and Surface Dial settings

Windows 10's Mouse & Touchpad settings have been split into separate sections to greatly expand the number of touchpad options available. Inside the Touchpad Settings' depths you'll find all sorts of tools that let you customize exactly what actions you want your three- and four-fingered gestures to enable. It looks seriously handy.

Did you pick up a Surface Studio all-in-one (go.pcworld.com/surfacestudiohandson)? There's also a new options page for Microsoft's radical Surface Dial (go.pcworld.com/surfacedialhandson).

Unified devices

The main Devices page in Windows 10's Settings has been tweaked to show all the devices connected to your PC in one centralized location, from mouse to keyboard to Surface Pen. It's a major quality-of-life improvement on having to scrounge across numerous submenus to find info on all your PC hardware.



Better theme support

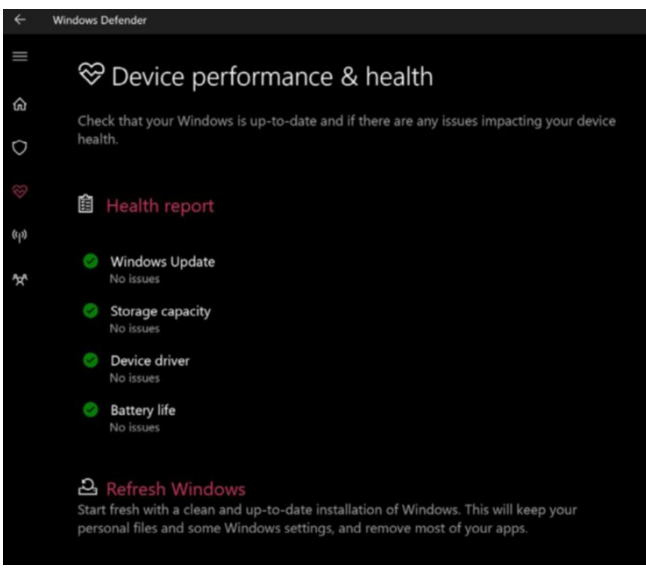
The Windows 10 Creators Update packs enhanced options for people who want to customize the look of their PCs. Theme control has been moved into the Personalization section of the Settings app, and now you can choose Theme accents from the entire color spectrum rather than a handful of predefined options. Don't worry; if you pick a garish combination, it looks like Windows will warn you that it's difficult to read. You'll also be able to buy new themes from the Windows Store.

Now you're playing with PowerShell

The Creators Update pushes the tried-and-true Command Prompt into the background in favor of the fuller-featured PowerShell. Now, when you right-click the Start button or an open space in File Explorer, you'll see options to launch PowerShell instead.

Fear not! Command Prompt isn't being discarded, just de-emphasized. It'll still be installed, and you'll be able to open it manually if you'd like.

Windows Defender overhaul



Windows 10's default antivirus app receives a fresh new coat of paint in the Creators Update, along with new scanning options, reports on your PC's performance and health, and more.

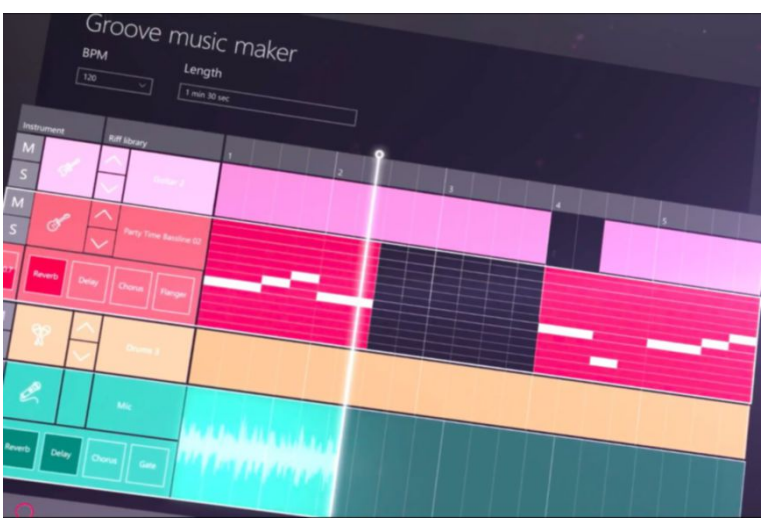
Defender's also adding a link to Refresh your PC, a (mostly) nuclear option that has lurked deep within Windows' settings since Windows 8. Refresh reinstalls and updates Windows, wiping most of your apps but keeping your personal files and settings intact. Approach it cautiously, but Refresh may be just what the doctor ordered when a particularly nasty malware strain ensnares your computer.

Green Screen of Death

RIP Blue Screen of Death (go.pcworld.com/ripbsd)—at least for Windows Insiders. Microsoft's changing the background color of its infamous crash dumps to green for Windows Insiders, making it easier to identify when an error happens in a preview build rather than a production build of Windows 10. Fits the *Minecraft* vibe, eh?

Windows 10 stroke eraser

Think of it as a Crtl-Z for your doodles. To be honest, it's surprising Microsoft launched Windows Ink *without* this feature.



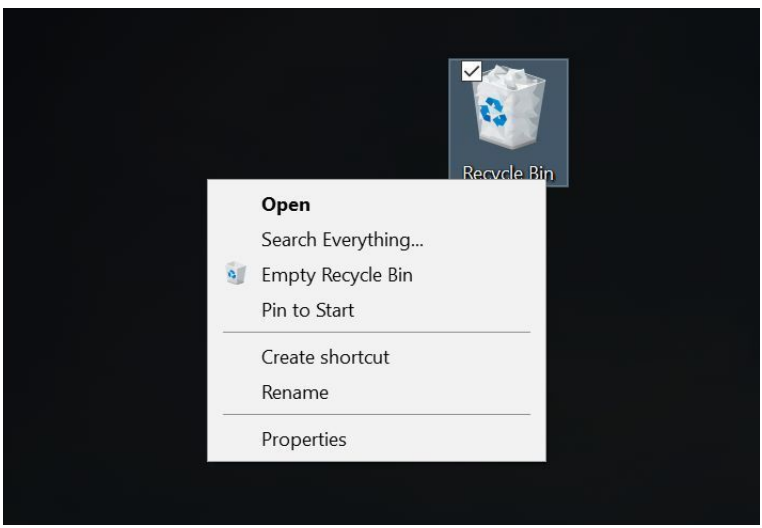
Groove music maker

Move over, GarageBand? In a sizzle video of Creators Update highlights, an ultra-brief clip revealed a Groove music maker app that lets people mix instrumental and vocal tracks as well as apply basic effects. Microsoft hasn't formally announced the app, however.

Virtual virtues

Two final Creators Update additions cater to the business crowd.

Streamlined virtual private network (VPN) support makes it possible to easily activate a connection without opening your network connections once Windows knows your VPN credentials; while a new Quick Create option makes it easy to deploy Hyper-V virtual machines lickety-split.



Space savings

Finally, all these new features and functions gobble up precious storage space, and yet another new feature helps to free it back up. A new option in Windows 10's storage settings—which is off by default—will automatically delete unneeded items when you're short on space. The initial version eradicates temporary Internet files and anything you've had in your Recycle Bin for over 30 days.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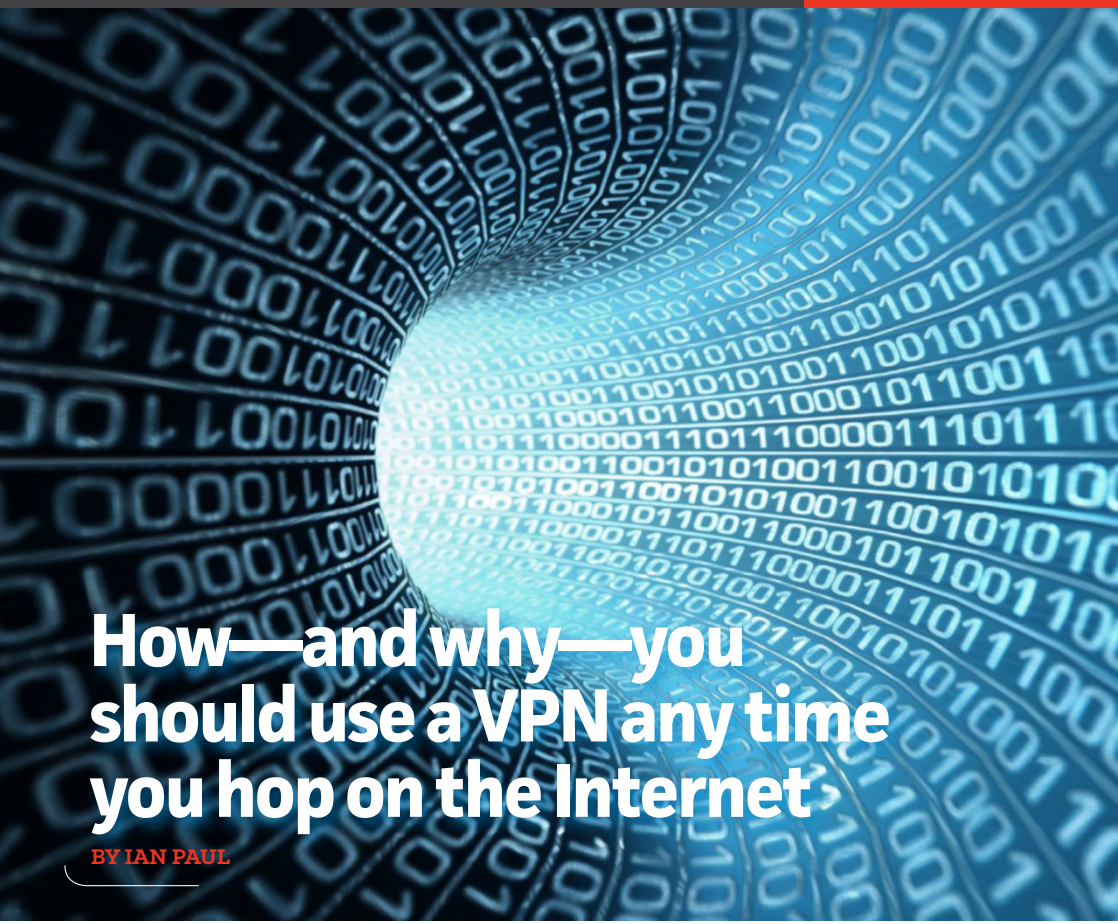
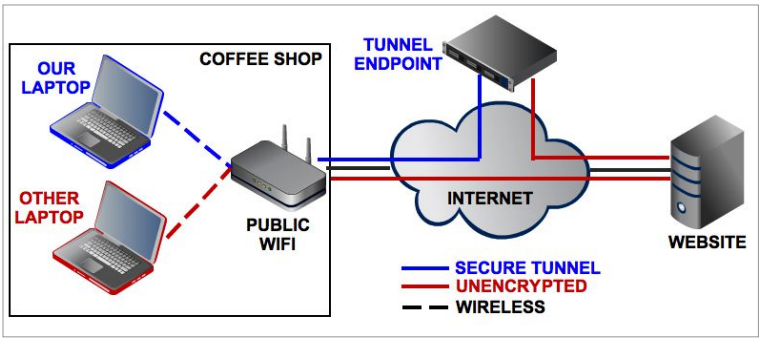


How—and why—you should use a VPN any time you hop on the Internet

BY IAN PAUL

ONE OF THE most important skills any computer user should have is the ability to use a virtual private network (VPN) to protect their privacy. A VPN is typically a paid service that keeps your web browsing secure and private over public Wi-Fi hotspots. VPNs can also get past regional restrictions for video- and music-streaming sites and help you evade government censorship restrictions—though that last one is especially tricky.



A VPN is like a secure tunnel for web traffic.

The best way to think of a VPN is as a secure tunnel between your PC and destinations you visit on the Internet. Your PC connects to a VPN server, which can be located in the United States or a foreign country like the United Kingdom, France, Sweden, or Thailand. Your web traffic then passes back and forth through that server. The end result: As far as most websites are concerned, you're browsing from that server's geographical location, not your computer's location.

We'll get to the implications of a VPN's location in a moment, but first, let's get back to our secure tunnel example. Once you're connected to the VPN and are "inside the tunnel," it becomes very difficult for anyone else to spy on your web-browsing activity. The only people who will know what you're up to are you, the VPN provider (usually an HTTPS connection can mitigate this), and the website you're visiting.

When you're on public Wi-Fi at an airport or café, that means hackers will have a harder time stealing your login credentials or redirecting your PC to a phony banking site. Your Internet service provider (ISP), or anyone else trying to spy on you, will also have a near impossible time figuring out which websites you're visiting.

On top of all that, you get the benefits of spoofing your location. If you're in Los Angeles, for example, and the VPN server is in the U.K., it will look to most websites that you're browsing from there, not southern California.

This is why many regionally restricted websites and online services such as BBC's iPlayer or Sling TV can be fooled by a VPN. I say "most"

services because some, most notably Netflix, are fighting against VPN (ab)use to prevent people from getting access to, say, the American version of Netflix when they're really in Australia.

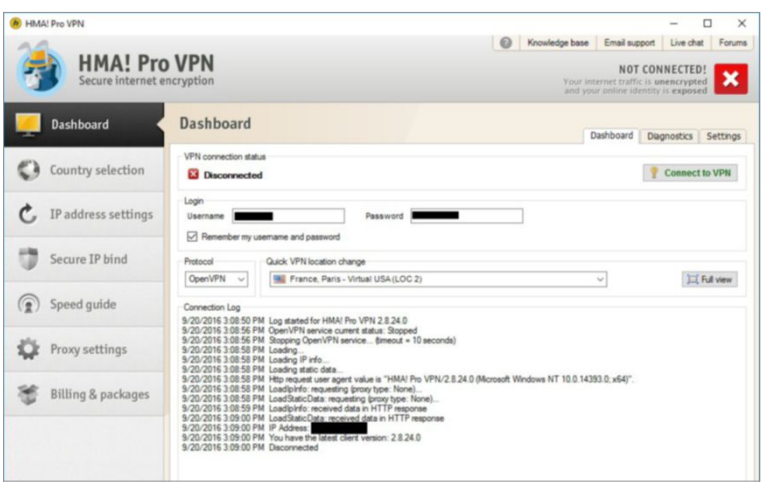
For the most part, however, if you're visiting Belgium and connect to a U.S. VPN server, you should get access to most American sites and services just as if you were sitting at a Starbucks in Chicago.

What a VPN can't do

While VPNs are an important tool, they are far from foolproof. Let's say you live in an oppressive country and want to evade censorship in order to access the unrestricted web. A VPN would have limited use. If you're trying to evade government restrictions (go.pcworld.com/esccensor) and access sites like Facebook and Twitter, a VPN might be useful. Even then, you'd have to be somewhat dependent on the government's willingness to look the other way.

Anything more serious than that, such as mission-critical anonymity, is far more difficult to achieve—even with a VPN. Privacy against passive surveillance? No problem. Protection against an active and hostile government? Probably not.

The problem with anonymity is there are so many issues to consider—



A VPN service provider such as HideMyAss can protect your privacy by ensuring your Internet connection is encrypted.

most of which are beyond the scope of this article. Has the government surreptitiously installed malware on your PC in order to monitor your activity, for example? Does the VPN you want to use have any issues with data leakage (go.pcworld.com/vpnsafety) or weak encryption that could expose your web browsing? How much information does your VPN provider log about your activity, and would that information be accessible to the government? Are you using an anonymous identity online on a PC that you never use in conjunction with your actual identity?

Anonymity online is a very difficult goal to achieve. If, however, you are trying to remain private from prying eyes or evade NSA-style bulk data collection as a matter of principle, a reputable VPN will probably be good enough.

Beyond surveillance, a VPN also won't do much to keep advertisers from tracking you online. Remember that the website you visit is aware of what you do on its site and that applies equally to advertisers serving ads on that site.

To prevent online tracking by advertisers and websites you'll still need browser add-ons like Ghostery, Privacy Badger, and HTTPS Everywhere.

How to choose a VPN provider

There was a time when using a VPN required users to know about the built-in VPN client for Windows or universal open-source solutions such as OpenVPN. Nowadays, however, nearly every VPN provider has their own one-click client that gets you up and running in seconds. There are usually mobile apps as well to keep your Android or iOS device secure over public Wi-Fi.

Of course that brings up another problem. Since there are so many services to choose from, how can you tell which ones are worth using, and what are the criteria to judge them by?

First, let's get the big question out of the way. The bad news for anyone used to free services is that it pays to pay when it comes to a VPN. There are tons of free options from reputable companies, but these are usually a poor substitute for the paid options. Free services usually allow a limited amount of bandwidth usage per month or offer

a slower service. Tunnel Bear, for example, offers just 500MB of free bandwidth per month, while CyberGhost offers a free service that is significantly slower than its paid service.

Then there are the free VPNs that use an ad-supported model, which in my experience usually aren't worth using at all. Plus, free VPNs are usually anything but; in lieu of payment they may be harvesting your data (in anonymized form of course) and selling it as "marketing insights" to advertisers.

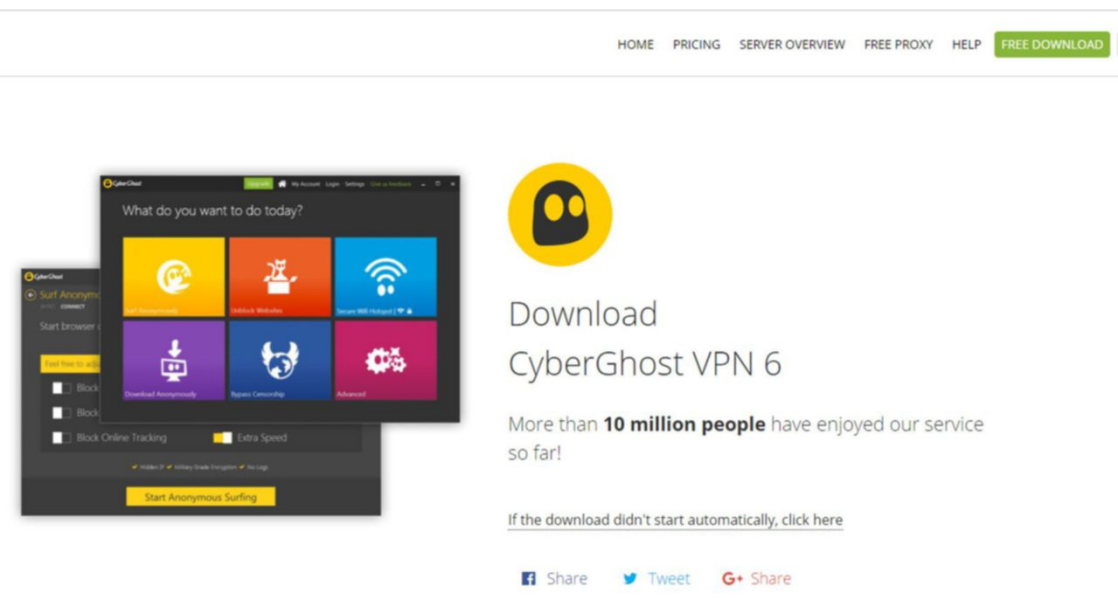
The good news is VPNs aren't expensive. You can usually pay as little as $5 a month (billed annually or in blocks of several months) for VPN coverage.

We won't get into specific VPN service recommendations in this article; instead, here are some issues to consider when shopping around for a VPN provider.

First, what kind of logging does your VPN provider do? In other words, what information do they keep about your VPN sessions and how long is it kept? Are they recording the IP addresses you use, the websites you visit, the amount of bandwidth used, or any other key details?

All VPNs have to do some kind of logging, but there are VPNs that

Everybody loves free services; but when you want to use a VPN, the free version usually isn't the best deal.



collect as little data as possible and others that aren't so minimalist. On top of that, some services discard their logs in a matter of hours or days while other companies hold onto them for months at a time. How much privacy you expect from your VPN-based browsing will greatly influence how long you can stand having your provider maintain your activity logs—and what those logs contain.

Second, what are the acceptable terms of use for your VPN provider? Thanks to the popularity of VPNs with torrent users, permissible activity on specific VPNs can vary. Some companies disallow torrents completely, some are totally fine with them, while others won't stop torrents but officially disallow them. We aren't here to advise pirates, but anyone looking to use a VPN should understand what is and is not okay to do on their provider's network.

Finally, does the VPN provider offer their own application that you can download and install? Unless you're a power user who wants to mess with OpenVPN, a customized VPN program is really the way to go. It's simple to use and doesn't require any great technical knowledge or the need to adjust any significant settings.

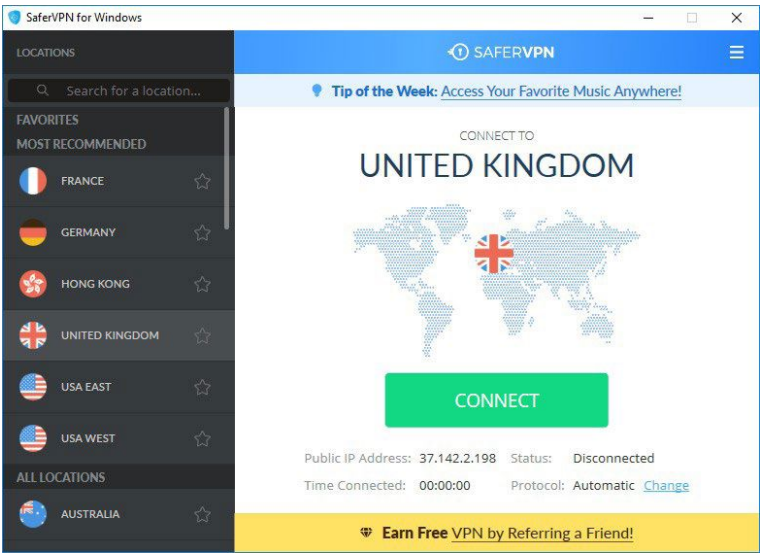
Using a VPN

You've done your due diligence, checked out your VPN's logging policies, and found a service with a great price and a customized application. Now, for the easy part: connecting to the VPN.

Here's a look at a few examples of VPN desktop applications.

TunnelBear, which is currently my VPN of choice, has a very simple interface—if a little skeuomorphic. With Tunnel Bear, all you need to do is select the country you want to be virtually

TunnelBear is one of the author's favorite VPNs, but there are many good choices on the market.



With SaferVPN, all you need to do is choose the country you wish to have a virtual presence in.

present in, click the dial to the On position, and wait for a connection-confirmation message.

SaferVPN works similarly. From the left-hand side you select the country you'd like to use—the more common choices such as the U.S., Germany, and the U.K. are at the top. Once that's done, hit the big Connect button and wait once again for the confirmation message.

HMA Pro's interface is slightly more complicated, but it's far from difficult to understand. If you want to select your desired virtual location click the Location Mode tab, click on the location name, and then choose your preferred location from the list. Once that's done, click the slider button that says Disconnected. Once it flips to Connected, you're ready to roll.

There are numerous VPN services out there, and they all have different interfaces; but they are all similar enough that if you can successfully use one, you'll be able to use the others.

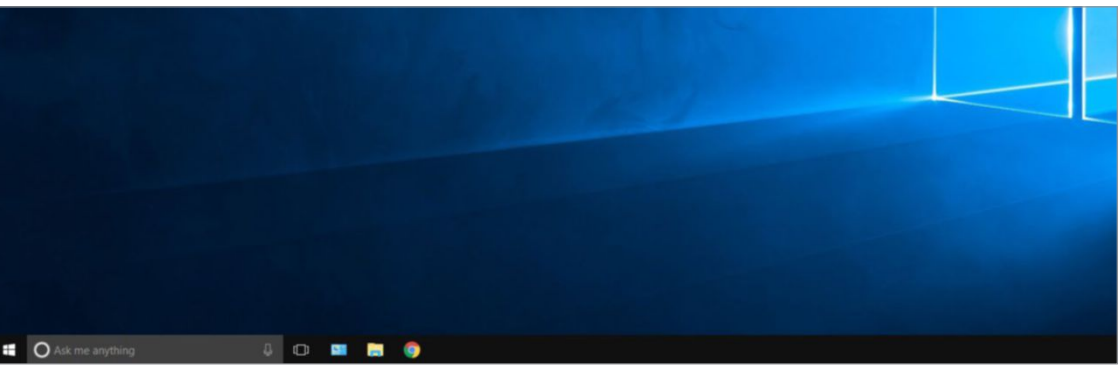
That's all there is to using a VPN. The hard part is figuring out which service to use. Once that's done, connecting to a VPN for added privacy or to stream your favorite TV shows while abroad is just a click away.

How to incorporate keyboard shortcuts into your workflow

BY IAN PAUL

USING KEYBOARD SHORTCUTS may seem complicated since you have to memorize a bunch of key combinations. However, when it comes to efficiency you just can't beat them. It's much faster (and eventually easier) to keep your hands on the keyboard while navigating around your PC.

Still, it can be hard to know where to get started with keyboard shortcuts (go.pcworld.com/stickyscuts). I talk about this briefly in reference to the shortcut-oriented Chrome browser extension Vimium (go.pcworld.com/vimiumskeycut)—a must-have extension in my opinion.



To give shortcut newbies a possible usage template, I've broken down how I use keyboard shortcuts on an average day.

Firing up programs

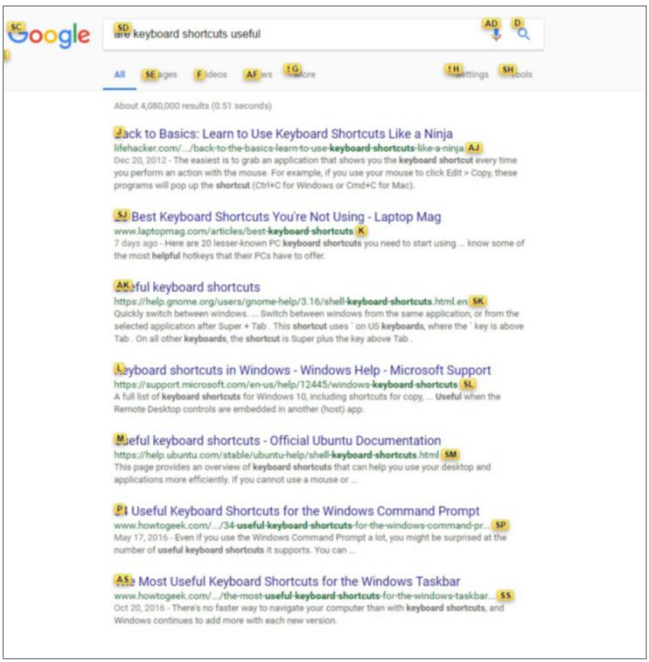
Personally, I just use the mouse or Cortana voice commands to open up programs, but you can use keyboard shortcuts as well. If you have anything pinned to your taskbar you can open each item using the Windows key plus a number shortcut. In the screenshot of my desktop above, I have the Control Panel, File Explorer, and Chrome pinned to my taskbar. To start my day by opening Chrome, I'd use Win-3 (Chrome is the third program pinned to the taskbar). To open File Explorer, I'd use Win-2.

Another method is to just hit the Windows key to open the Start menu (on Windows 7 and 10), and then scroll through the Start menu to find the right program. That is not very efficient, however. Another option in Windows 10 is to hit Win-C to call up Cortana and search for each program.

Navigating the browser

Now that the programs are open—in my case Chrome, OneNote, Outlook 2016, Slack, and Sublime Text 2—it's time to get to work. After checking in with the news team in Slack, I switch to the browser using Alt-Tab and get to work on my research for whatever the news topic is.

When in the browser, I personally use a combination of standard Chrome browser shortcuts, as well as the specialized navigation features of Vimium. I need to open a new tab to do a Google search, so I hit t and then type my query into the address bar.



A Google results page with Vimium activated.

Turns out my query didn't quite get me what I wanted, so I hit Ctrl-L to highlight the contents of the address bar (the Google search query URL in this case), and then type in whatever my new query is.

Now this result gets me what I want, so I hit Shift-F, which is a Vimium command that says I want to open a link on the current page in a new tab. Vimium then labels every possible link on the Google results page with a keyboard shortcut. That can get a little messy, but you get used to it. I hit the L key in this case and I'm off to the races.

On the new website, I start navigating the webpage using the J and K keys to scroll up and down the page as I read. Once I get to the bottom, I realize I want to double-check some information at the top so I hit GG to jump back up. Oh, but what was that thing I wanted from the bottom again? I hit the G key to jump right back to the bottom.

My research is now done and stored in OneNote via a quick succession of Alt-Tab shortcuts to switch between OneNote and Chrome. Now it's time to go back to the Google search tab, so I hit Shift-J to move to the next tab to the left in Chrome. I find another page I want to check out

in the search results, and I'm back to the races. This time, however, I land on a page where, for whatever reason, Vimium just isn't working that well—these pages are rare but it happens.

I can navigate up and down the page, but I can't jump back with a Shift-J. No problem, Chrome has a built-in keyboard navigation shortcut. Google occupies the second tab in my window, so I hit Ctrl-2 and I'm back where I started.

I go through a few more pages, close a bunch of tabs using Vimium's close tab command (a simple *x*), and then it's time to get to work writing the news story.

At this point, I hit Alt-Tab again to jump into Sublime Text. I might hit the Windows key plus the right arrow to snap Sublime to the right-hand side of the screen, and then use the mouse (apostasy!) to select OneNote as the program to occupy the left of the screen.

After the research is done, I give up on keyboard shortcuts of any kind and use the traditional keyboard and mouse setup. Keyboard diehards could take their love of efficiency to an extreme by customizing Sublime to work like Vim (go.pcworld.com/vimte)—a keyboard-controlled text editor that inspired Vimium—but hey, I'm not a maniac.

4 Linux projects for newbies and intermediate users

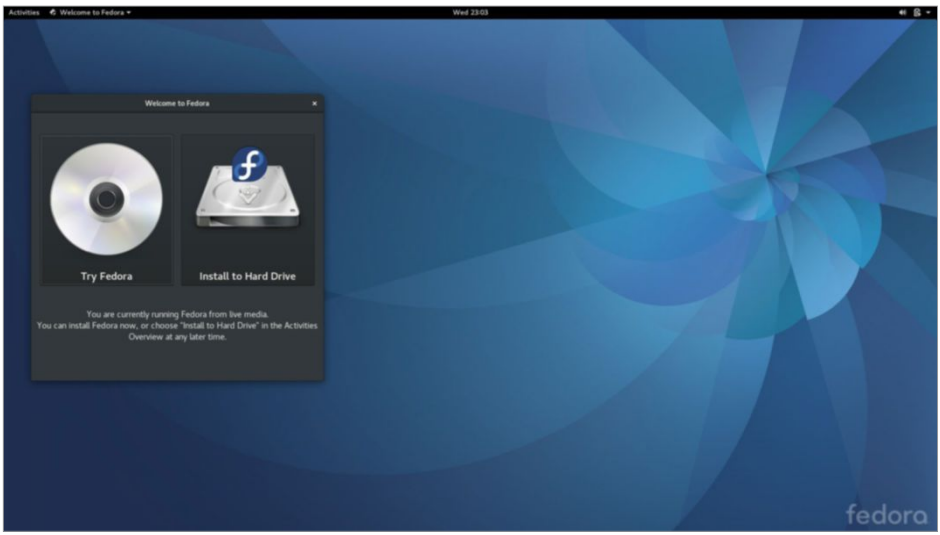
BY ALEX CAMPBELL

IT'S THE NEW year, and everyone is back at work and school. Maybe you no longer have the leisure time vacation affords, but perhaps you promised yourself to learn more about Linux this year.

A small project that doesn't take too long to do can be rewarding, and it may yield future benefits. Here are a few ideas that shouldn't take more than a few hours.

1. Try a new Linux distro

A lot of Linux users love the OS because of the level of customization it allows. Once everything is set up just right, workflows can be quicker, and computing can be more personal and enjoyable. But sometimes it's good to step out of your comfort zone.



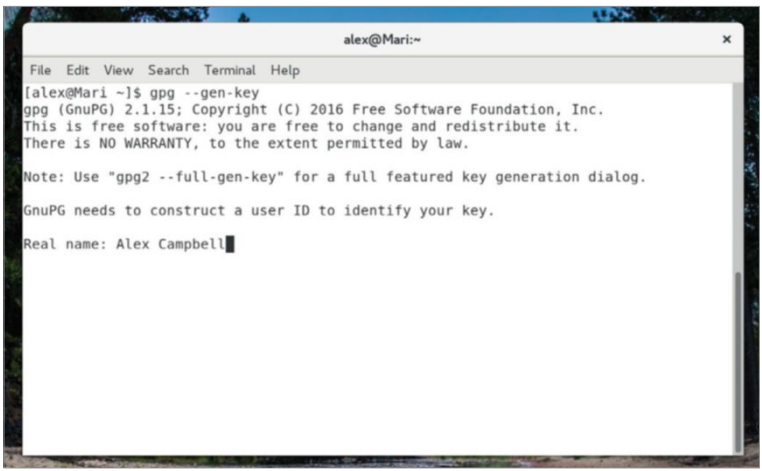
Trying a new distribution might be trivial to some, but to others it might be like trying sushi when your favorite food is pizza. It can feel strange. You might not like it, but who knows? Maybe you'll fall in love all over again.

If you've never tried running a Linux operating system, this is a great time to dip your toes in the water. Total novices might want to try Fedora 25 (go.pcworld.com/fedora25rv) because of the ease of writing the image to a USB stick. Canonical's Ubuntu 16.04 (go.pcworld.com/ubuntu16041) is also a good toe-dipper. Both operating systems can run "live" on a USB drive (meaning you don't have to go full-bore and nuke Windows if you're just looking to test-drive).

For users who have been running Fedora or a flavor of Ubuntu for a while and feel like they have it down, playing with Gentoo (gentoo.org) or Arch Linux (archlinux.org) will present a bit more challenge when it comes to setup, but will offer a great learning experience.

2. Create an OpenPGP keypair

Creating an OpenPGP keypair is a great way to learn how public-key



A Google results page with Vimium activated.

encryption tools work. Some Linux distributions come with GnuPG (called **gpg**) preinstalled, since the OS needs it to verify the signatures of packages.

Creating a keypair in Linux is pretty easy, and can be accomplished by running **gpg --gen-key** in a terminal window. The Fedora Wiki (go.pcworld.com/fedoragpg) has a great tutorial on creating keys in KDE, GNOME, and through the command line. If you're using Windows, you can use GPG4Win to create keys (go.pcworld.com/opengpgemail).

While OpenPGP is far from perfect (secushare.org/PGP)—most people don't want to encrypt stuff from the command line, and a lot of desktop applications feel clunky—it's still worth learning. For now, OpenPGP is one of the strongest encryption tools out there.

If you're going to create keys for messing around, a key with the default depth of 2,048 bits is just fine. I prefer 4,096-bit keys for my real-world keypair. It's also a good idea to create a revocation certificate (to tell the world if your keys are obsolete or stolen), and to have a safe backup (as in not on your PC or phone) of your private key. And finally, always try to create keys on your PC instead of a phone or tablet.

3. Create a backup scheme

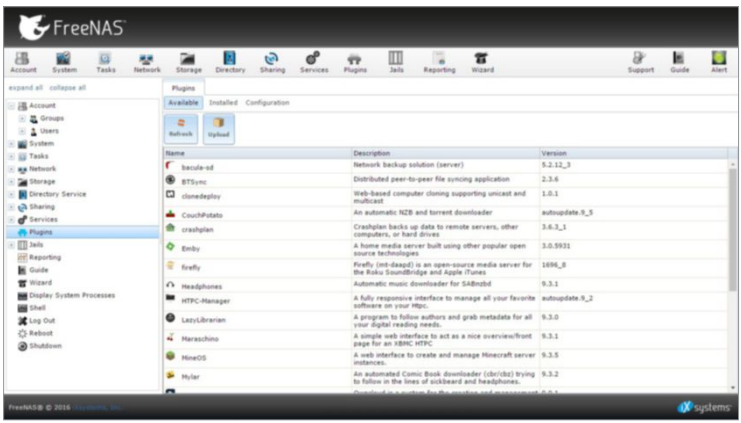
Like saving for retirement, the best time to start backing up is yesterday. The second-best time to start backing up is now. I speak from personal experience: I once had to pay about $1,000 to recover a hard drive full of photographs that spanned eight years.

Some backup services can back up your files automatically, but you can make local backups using Linux programs like **`rsync`**. Rsync is a bit like a smarter copy command, in that it only copies over files that have changed. If you couple **`rsync`** with compression via **`tar`** and schedule it using the **`crontab`**, you can have automatic backups sent to your network attached storage (NAS) or remote server through SSH.

A new hard drive (used just for backups) or a cloud service might feel a bit pricey, but weigh that cost against your grief should the 3-year-old hard drive you've got your life on fails.

Just back up your stuff.

4. Build a NAS



Speaking of network storage, I'm a firm believer that everyone should have a NAS. You can think of your NAS as your own private cloud for your home. The thing is, NAS devices can be expensive, but not everyone needs an eight-drive hulking machine humming away in the closet. Luckily, it's easy to make one out of an old PC and a new hard drive or two.

The FreeBSD-based FreeNAS is a popular choice for home NAS machines. FreeNAS is pretty easy to set up, and can be run from a USB thumb drive so that the PC's hard drives can be used for storage only.

A popular Linux-based option is OpenMediaVault. Like FreeNAS, OMV has a plug-in system that allows you to install different software applications like the Emby media server. You can also install the containerization plug-in Docker on an OMV server. Used in conjunction with the personal cloud software Nextcloud, Docker would make it possible to access your files remotely as easily as you would with Dropbox or Google Drive.

If you're feeling up to the task, you can try doing all this yourself by setting up an Ubuntu or Fedora server, and using Docker to install the applications (like Nextcloud) that you need.

None of these projects should take very long, and they'll have some benefit down the road. If you've got a spare evening, it's worth taking some time to learn something new about Linux.

4 ways to block political posts on Facebook

BY ALEX CAMPBELL

IF YOU THOUGHT that deluge of political rants, memes, and arguments in your Facebook feed would end with the 2016 Presidential Election, think again. If anything, the thrum of political debate has only grown louder since the final votes were tallied. Whether you participate in these posts, just seeing them is proven to be wearing and stressful, and can ultimately be a drain on your productivity.

You don't necessarily have to swear off social media completely to get relief, nor do you have to start a campaign of "unfriending" folks with offending opinions. There are several free browser add-ons that will help you purge your feed of politics—or at least keep it out of sight long enough to get your work done. Here are a few of the best.

Remove All Politics From Facebook

You've likely dreamed of a solution that would remove only politics-related posts from your feed, while leaving the funny pet videos and other more enjoyable content. That's exactly what this Chrome add-

Remove All Politics From Facebook scrubs your feed clean of post-election prattle.

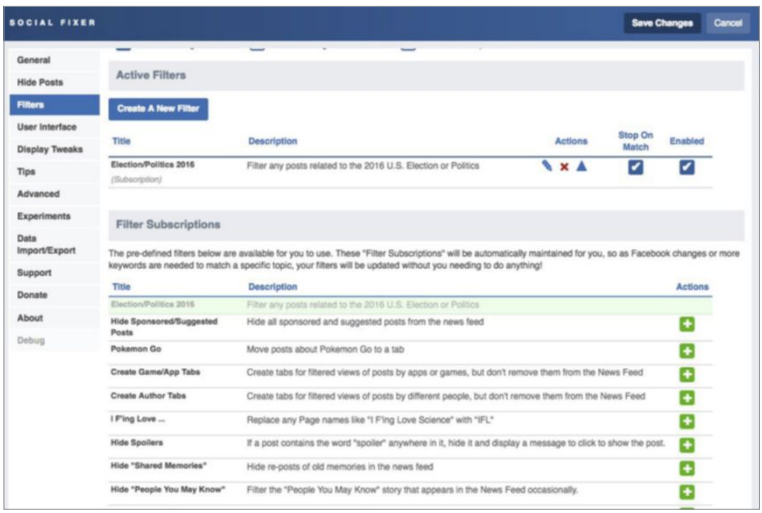
on boldly promises to do.

Remove All Politics From Facebook (go.pcworld.com/rapfb) installs a simple switch in your browser. If you want to hear the unfiltered voice of the American people—at least the ones in your Facebook feed—flick the switch to On. If you don't, toggle it to Off. The developer doesn't say how the add-on identifies which posts are political and which aren't, but my best guess based on usage is that it filters according to keywords and names. There's no way to customize the filter, but if you want a set-it-and-forget-it solution, this one works. (Chrome)

Social Fixer

Like Remove All Politics From Facebook, Social Fixer (socialfixer.com) also blocks political posts from your feed, but it gives you a little more latitude in how they're filtered.

Social Fixer adds a wrench icon to Facebook's toolbar. To customize your feed, click it, select Social Fixer Options and scroll down to Filters. If you just want to impose a sweeping moratorium on all political posts, enable Election/Politics 2016 from the list of predefined filters. This will



Social Fixer uses both predefined and custom filters to block political posts—and a whole lot else.

hide posts about anything related to the recent presidential election.

If you only want to filter posts about a certain political party, issue, or person, click Create A New Filter. Here you can set your own conditions for what to hide, using keywords.

Social Fixer can actually filter a variety of posts, including sponsored ads and spoilers, and help you customize your Facebook experience in a number of other ways, so it's worth keeping around after the political climate calms down. (It's going to calm down, right?) (Chrome, Firefox, Opera, Edge, and Safari)

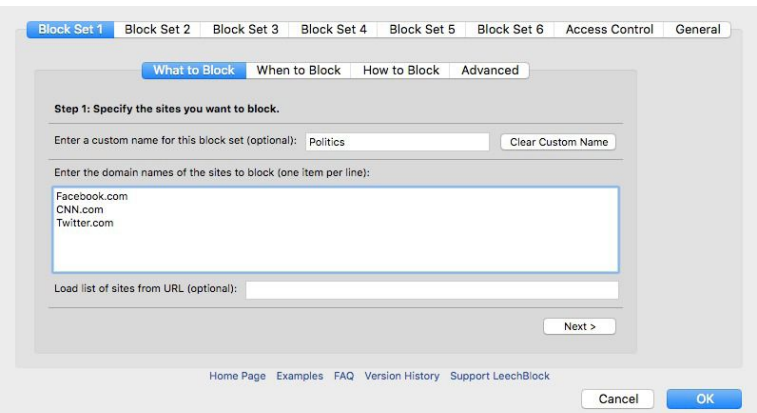
News Feed Eradicator for Facebook

Filters will go a long way toward purging your feed of political articles and their ensuing flame wars. But they can't block snarky memes, many posters' preferred way of voicing their

News Feed Eradicator for Facebook blocks access to your feed and live ticker only, while still letting you get to individual profiles.

opinions. To truly ensure you aren't distracted by political posts in your feed is to block it altogether.

The News Feed Eradicator (go.pcworld.com/nfe) for Facebook removes your news feed and live ticker altogether. But unlike similar add-ons, it replaces them with an inspirational quote to keep you motivated and productive. You can even add your own. (Chrome)



Add Facebook and other politically charged sites to LeechBlock and designate times to restrict access.

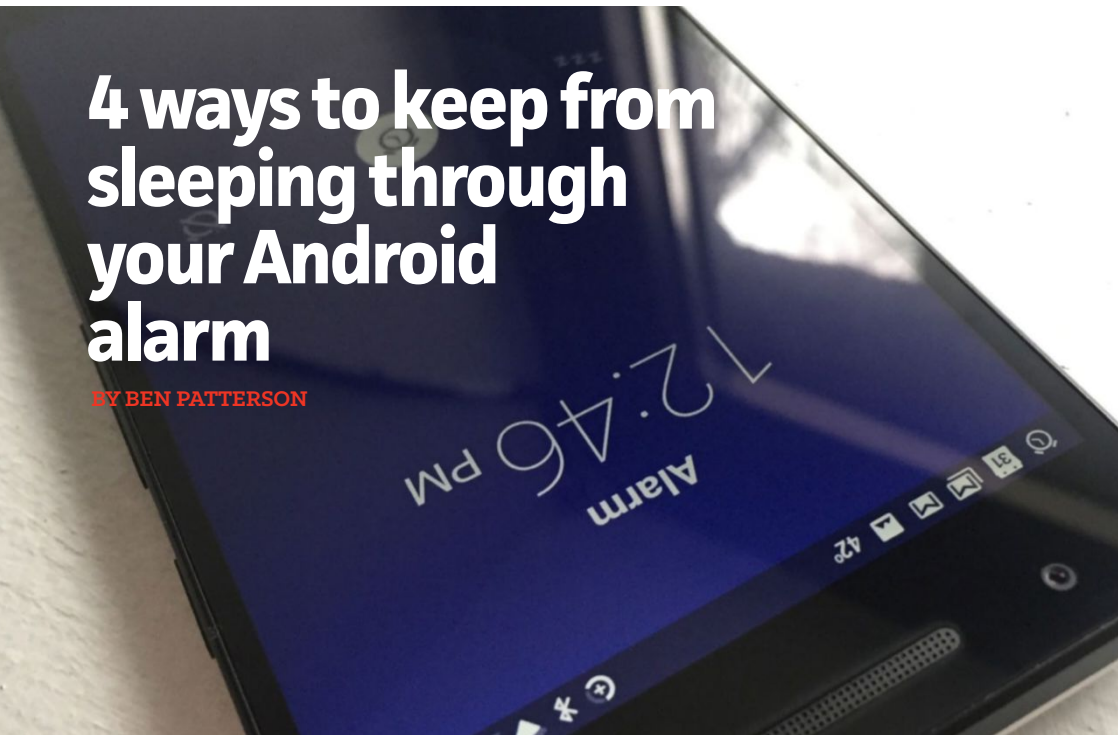
LeechBlock

If all else fails, there's always, if you'll pardon the expression, the nuclear option: blocking your access to Facebook completely.

LeechBlock (go.pcworld.com/leechblk) bars the door to any site you tell it to. You can add up to six domains—so feel free to toss Twitter, major news sites, and any other political forum into the mix as well—and block them for specific time periods you define (during work hours, for example). By keeping a lid on your feed only when you need to get things done, you'll reduce your exposure to potentially productivity-sucking posts when it matters most.

4 ways to keep from sleeping through your Android alarm

BY BEN PATTERSON



I LIKE TO think of myself as a reasonably punctual, conscientious guy who shows up when he says he's going to show up. So imagine my embarrassment when I dozed right through my Android alarm on a recent morning, missing an early meeting and earning a reproachful glare from my hungry 4-year-old.

What happened? I did, after all, have my Android Clock app set to wake me at 6:30 a.m., and it's not like I didn't hear the buzzer; it simply never went off.

As it turns out, there are plenty of reasons why an Android alarm might fail to buzz. Maybe your Do Not Disturb rules are to blame, or perhaps you're being a tad too aggressive with Total Silence mode. And even if your Android alarm does buzz, you might have the volume set too low, or maybe it's just too easy to hit the snooze button.

Check your Do Not Disturb rule settings

As you may already know, Android's Do Not Disturb mode (go.pcworld.com/andsdnd) lets you set "rules" that turn on your quiet times automatically—and if you're not careful, your Do Not Disturb rules may override any alarms you've set.

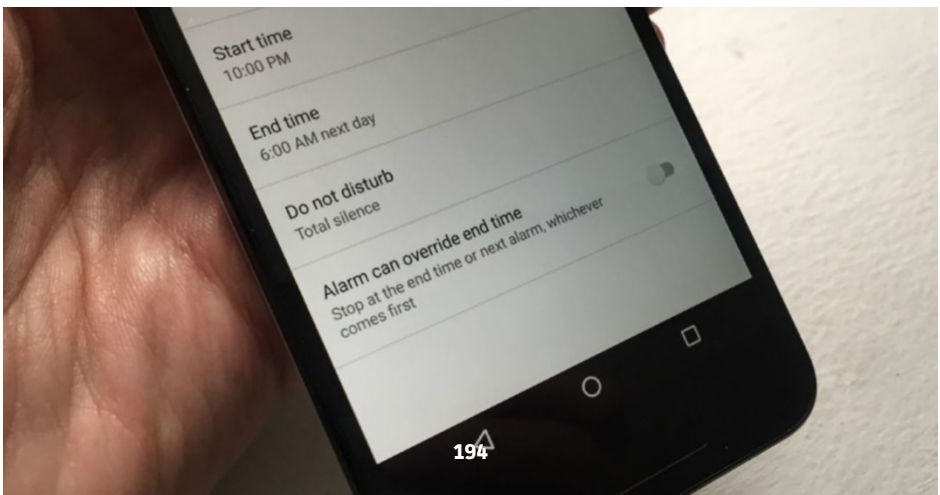
For example, I had a Do Not Disturb rule that set my Android device to Total Silence mode from 10 p.m. to 7 a.m. When I tried setting an alarm for 6:30 a.m., the alarm never went off, and I slept like a baby right through a meeting.

Now, if you tap the Do Not Disturb button in Quick Settings to manually switch your device to Total Silence mode, you'll get a warning if you're about to silence an alarm.

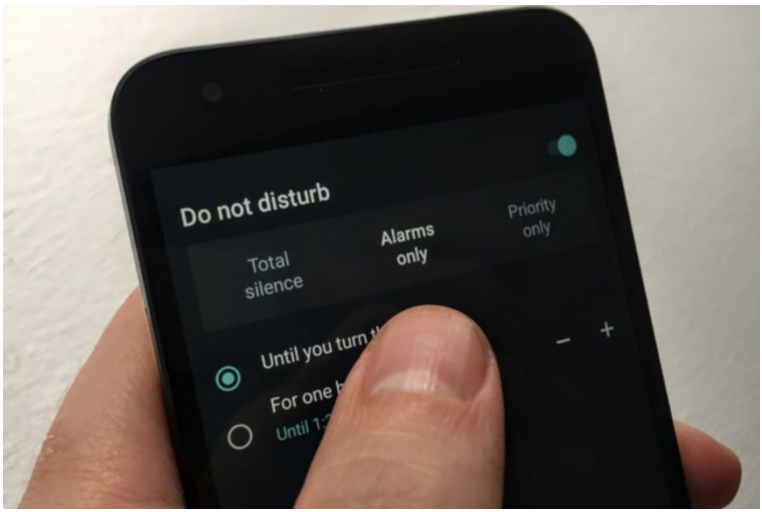
But Android will let you set an alarm during an upcoming Total Silence period without complaint, so be mindful of any Do Not Disturb rules that might conflict with your alarms.

And if you must use Total Silence mode for your Do Not Disturb rules, consider enabling the Alarm Can Override End Time setting, which ensures that your silent period will end before your next alarm goes off.

Bonus tip: The alarm icon in the top right corner of your Android screen will appear grayed out if your device is in Total Silence mode. Confusingly, though, the alarm icon will appear active even if your alarm is set to go off during an upcoming Total Silence period.



The Alarm Can Override End Time setting ensures that your silent period will end before your next alarm goes off.



Unless you absolutely, positively need total silence, consider another Do Not Disturb option, such as "Alarms only" mode.

Don't use Total Silence mode unless you absolutely have to

As a relative newcomer to Android (I've been testing Android phones for years, but I only recently started using an Android handset as my primary mobile device), my first inclination for Do Not Disturb mode was the Total Silence option. I liked how it muzzled absolutely every sound and vibration, from Gmail alerts to key taps, and Total Silence quickly became my favorite way of keeping my phone quiet at night.

Well, it turns out that was a bad idea, as I learned after sleeping through that aforementioned alarm. Indeed, unless you're at the movies, paying respects at a funeral, or otherwise determined not to make a sound, Total Silence mode is generally a bad idea, particularly when it comes to alarms.

A smart alternative is the Alarms Only option, which (as you can probably guess) silences all sounds and vibrations on your device except for alarms.

With the right customizations, Priority Mode is also a smart choice, since you can set it to silence everything except alarms as well as calls and messages from your closest contacts.

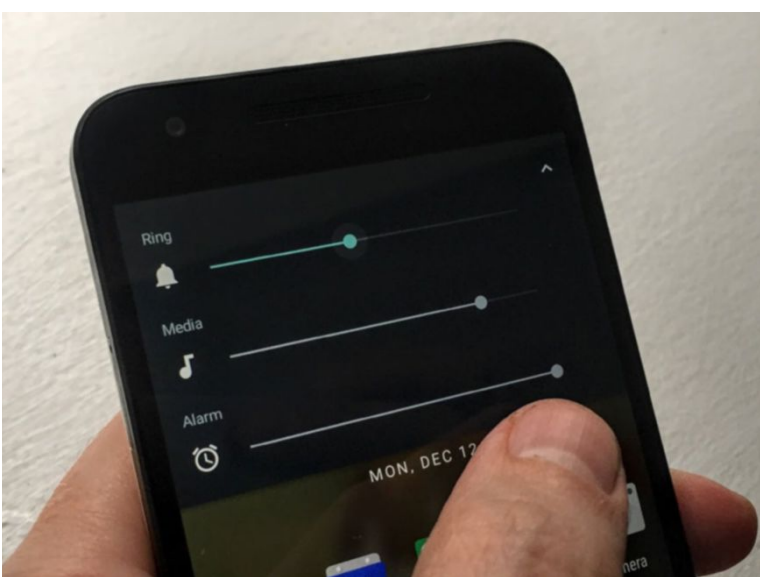
Check your alarm volume

Just because you cranked up the volume on your Android phone doesn't mean your alarm volume will be particularly loud.

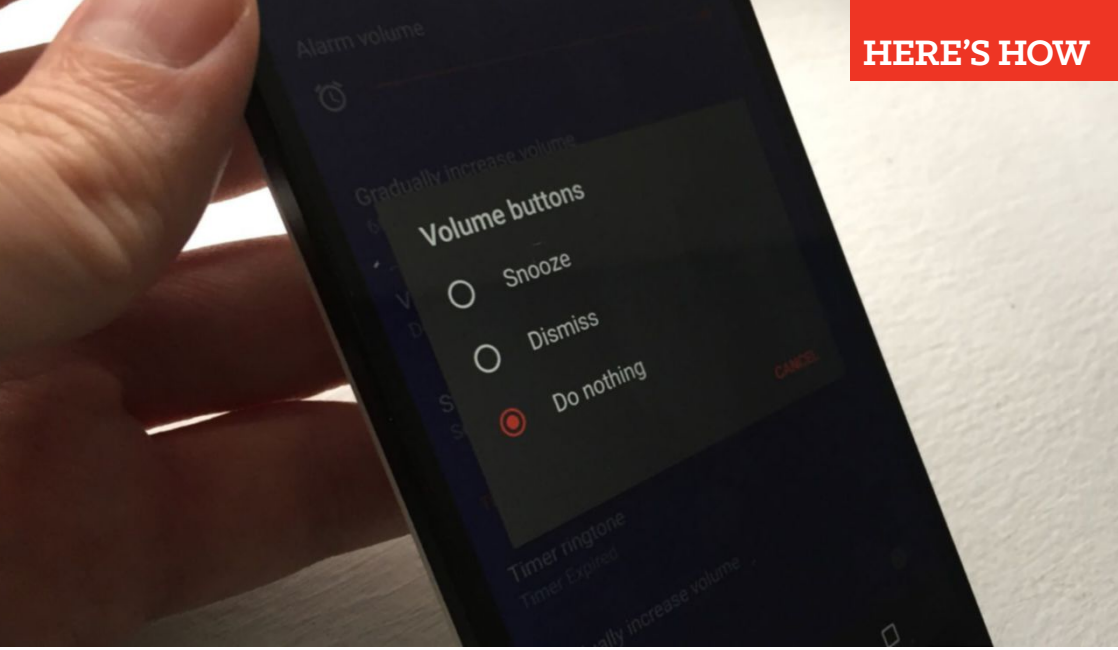
In fact, Android has three separate volume levels: one for ringers, another for media (like music and videos), and a third for alarms. Generally speaking, the volume rocker on your handset only controls the ringer volume.

If you want to boost your alarm volume, you'll need to tap the little down arrow that appears at the top of the screen when you tap the volume buttons; when you do, you'll reveal the three specific volume sliders, including the alarm volume. Go ahead and slide it up to 11.

Bonus tip: If you're worried about waking a loved one with your alarm tone, there's a setting that'll give you a chance to silence your alarm before it reaches full volume. Open the Clock app, tap the three-dot menu button in the top right corner of the screen, tap Setting > Gradually Increase Volume (under the Alarms heading), then pick a setting—anything from five seconds to a full minute.



There are actually three volume sliders on your Android device; the alarm volume is at the bottom.



Make it harder to snooze the alarm

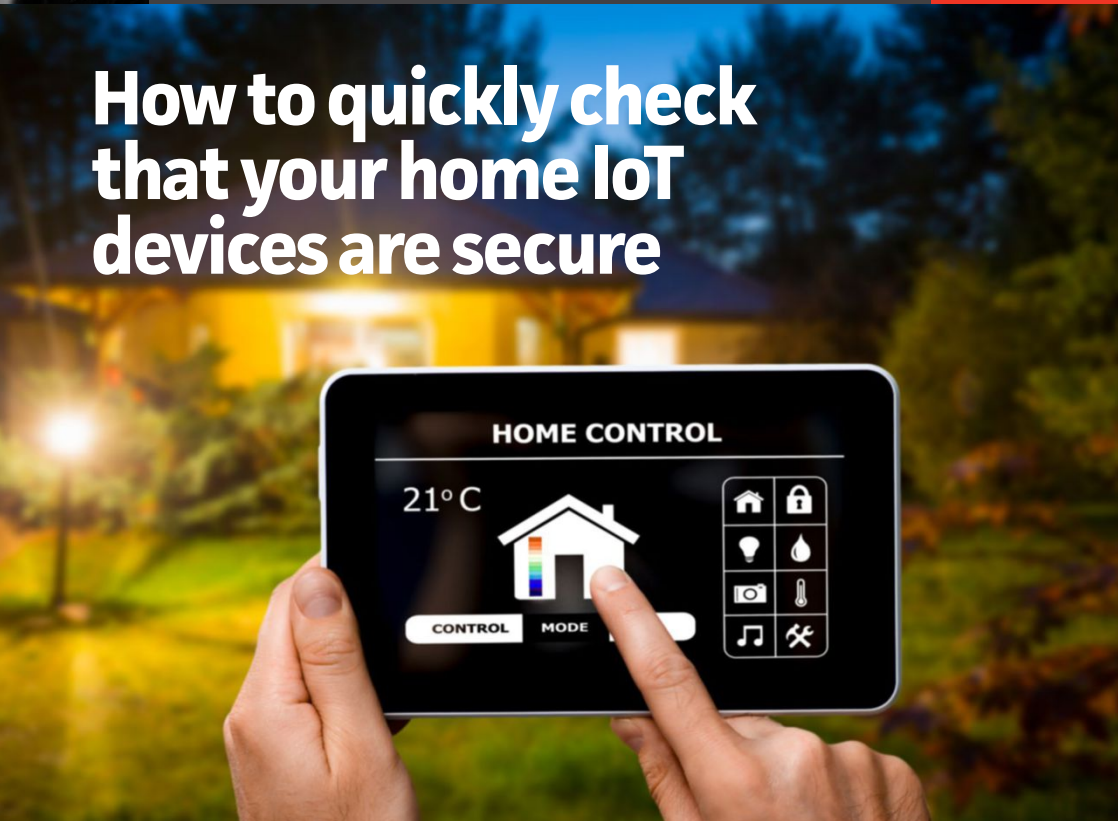
When your Android alarm starts blaring at the crack of dawn, it's easy to keep your eyes closed, reach over, and silence your alarm with a click of a volume button—maybe too easy, actually.

If you wish, you can enable a setting that makes it tougher to snooze your alarm while you're half-asleep.

Open the Clock app, tap the three-dot menu button, tap Settings > Volume Buttons, then pick an option besides Dismiss. For instance, Snooze might work if you trust yourself to only snooze your alarm a couple of times. If you're a chronic alarm snoozer, though, try the Do Nothing setting, which forces you to open your eyes and nudge the big touchscreen dot in the right direction.

Here's a setting that makes it a little tougher to snooze your alarm while you're half-asleep.

How to quickly check that your home IoT devices are secure



YOU'VE SPENT A good amount of time getting Alexa to properly activate your wireless speakers, living room lights, and smart cam, but is your new IoT setup secure?

BullGuard has a quick and easy tool that can help you find out if there are any basic problems. It's called the Internet of Things Scanner (iotscanner.bullguard.com). The service checks to see if any of your devices are on Shodan (go.pcworld.com/shodaneng), a search engine that lets anyone find Internet of Things devices like cameras, printers, and thermostats that are publicly accessible on the internet. Anything that's publicly accessible may also be vulnerable to hackers if there are any security flaws in the software that can be exploited.

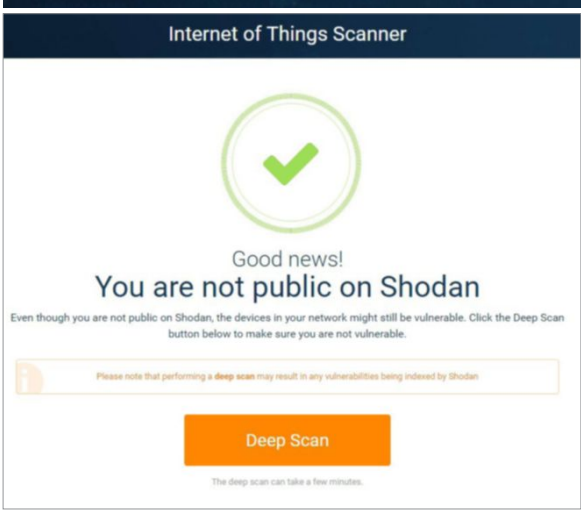
Using BullGuard's web app is easy, just land on the website and click

Check if I am on Shodan. A few seconds later you should have your answer. If all goes well, you'll see a result like the one, bottom right.

Next, you can click *Deep Scan* to take a look at devices on your network and see if BullGuard's scanner can find any security issues. The downside, BullGuard warns, is that a deep scan may cause vulnerable devices to be listed on Shodan. But if it does find any problems, BullGuard says it will offer details on how to secure your vulnerable devices.

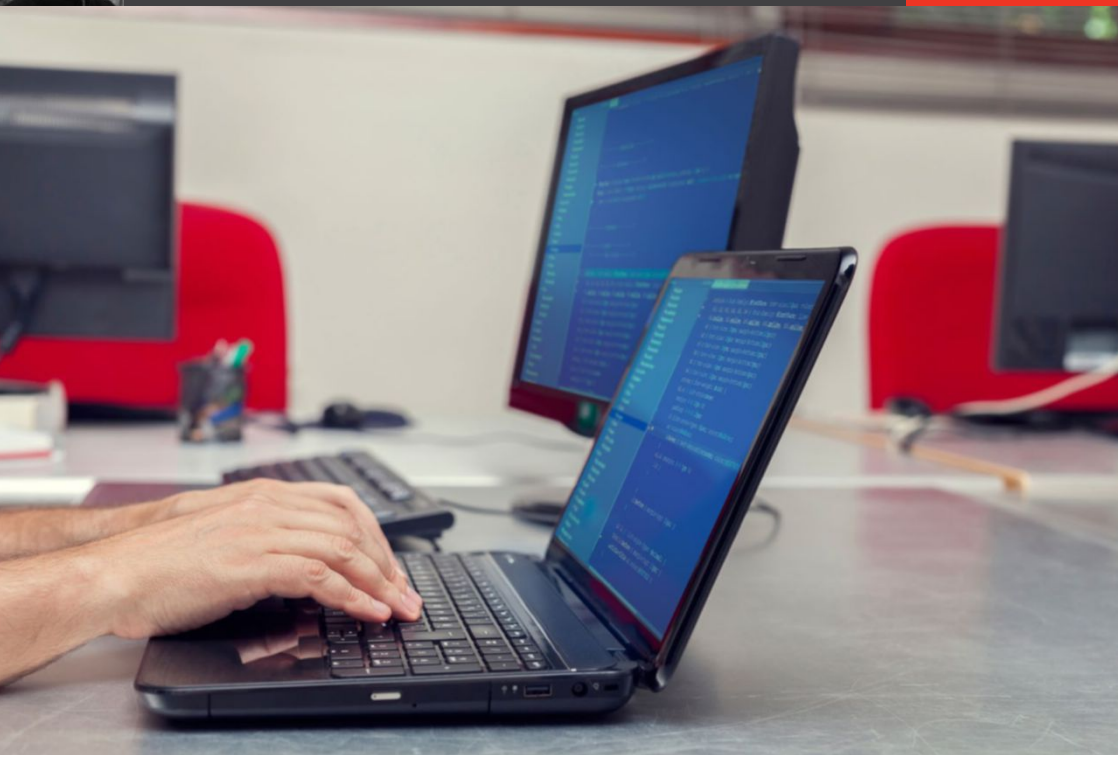
The company also has an IoT consumer guide (go.pcworld.com/bullguardcg) with three basic tips for securing your network that anyone should do regardless of whether they have smart devices at home or not: Set a password on your smartphone, change the default password for your router's administration features, and change your Wi-Fi network password from the default.

That's about all there is to BullGuard's IoT scanner. It's a simple way to check for any obvious vulnerabilities whenever you add any new devices to your growing collection of smart home devices.



BullGuard's Internet of Things Scanner (top) and the results after a scan (bottom).

IMAGE: BULLGUARD



4 Windows Command Prompt tricks everyone should know

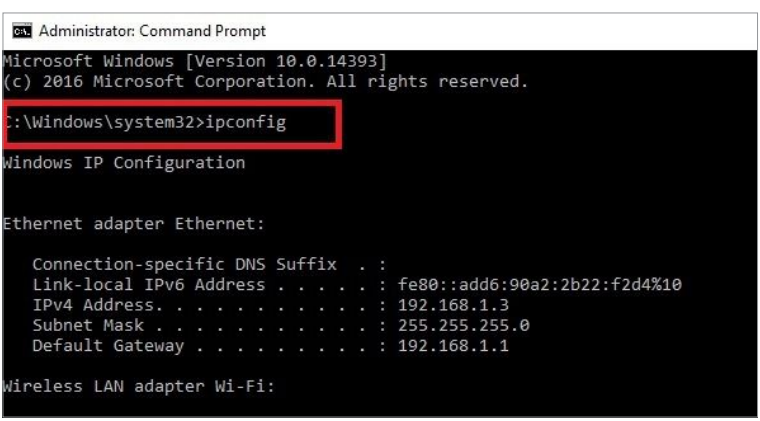
YOU'D THINK THE Command Prompt would be long-gone after 30 years of Windows' graphical interface, but it's not, and there's a good reason why. Though many of its duties have been replaced by icons or tiles, there are still things you can do better or faster from the command line, as any IT professional or PC tinkerer already knows.

Most users don't need to go this deep into the weeds (check out

Microsoft's A-Z reference, go.pcworld.com/msazref, if you do), but there are a few tasks and tricks that are handy for everyone to know.

To access the command prompt, right-click the start button in Windows 10 and select *Command Prompt*. You'll want to have admin rights on the device you're using to avoid permission issues. Note, too, that there's a second option called *Command Prompt (Administrator)* that gives you more rights than plain old Command Prompt (go.pcworld.com/w10cmdp).

Note that PowerShell may soon replace Command Prompt as the default shell (go.pcworld.com/w10cmdrumors) for command-line programming in Windows 10, but you can use these codes in either utility (and you'll still be able to find Command Prompt with a little extra digging.)



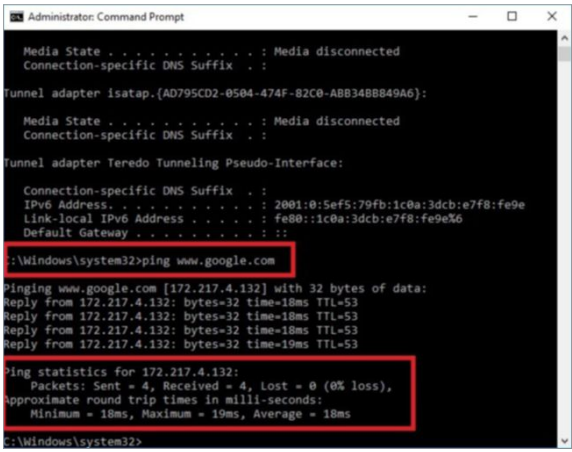
You can easily reset your internet connection with the ipconfig command.

1. Fix a flaky internet connection: ipconfig

I used to be a PC technician, and whenever we experienced flaky web connectivity on a machine the first thing we'd do is reset the connection via the command prompt. The way we did this was by typing **`ipconfig /release`**, which releases the connection (so don't do this if you need to be connected to the internet). Next, just type **`ipconfig /renew`** to reconnect to the internet with a new IP address.

Simply typing **`ipconfig`** will show you all the details of your internet

connection. One of the most useful is your gateway address, which is the IP address of your router. Type that address into a browser window to access your router.



I like to ping Google but you can ping any address as a test.

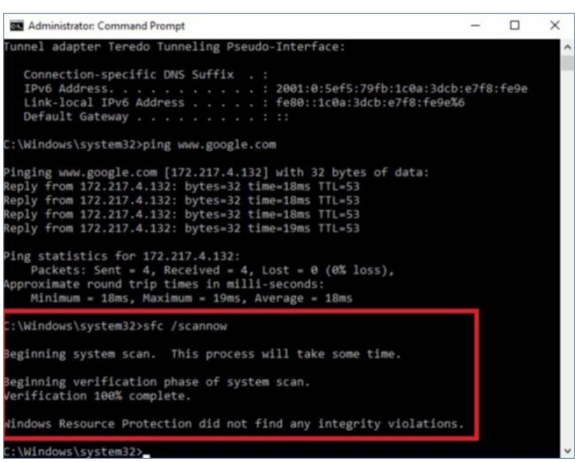
2. Check your connection: ping

We've all had that experience of trying to load a certain website and it just won't connect, and you're not sure whether it's the site's fault or your fault. In these situations I try to ping Google, as that tells me whether my internet connection can reach external destinations.

Open the command prompt and type **`ping www.google.com.`** This command sends packets of information out, waits for a response, then shows you how long the trip took and whether any packets were lost along the way. If your internet is working fine it'll reach the destination and respond back with no packet loss, and hopefully in a very short period of time (just a few seconds, typically).

3. Fix corrupted system files: sfc (System File Checker)

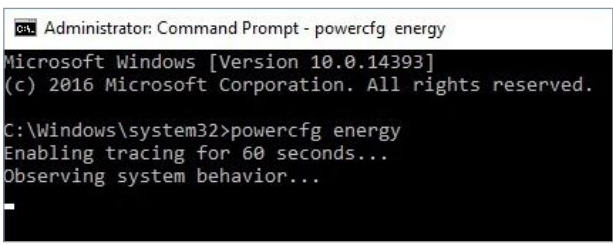
The System File Checker finds and fixes corrupted system files. I'll often advise readers who have difficult-to-diagnose issues to try it, as it's a useful baseline action to take when your operating system is acting weird.



You can easily fix corrupted system files via the command prompt.

For example, a reader was recently able to resolve an issue where an icon had disappeared from his taskbar—specifically, the icon for ejecting external drives safely. He fixed it by typing the command **sfc /scannow** and waiting for it to do its thing, which can take five to ten minutes depending on your system.

4. Examine your system's energy efficiency in detail: powercfg



You can examine in detail how your system uses power with the energy report.

One of the command prompt's least-known talents is its ability to analyze all kinds of behavior about your PC, including the way it uses power. Though it may be most useful for laptop users trying to conserve battery, it can also be handy for desktop users looking for system inefficiencies.

Open the command prompt and type **powercfg /energy.** The operating system will then analyze your system's power usage for 60 seconds and deliver a detailed report to your System32 folder (it will tell you the file's location).

Have a tech question? Send your query to answer@pcworld.com

You can also type **powercfg /batteryreport** for all the details on your system's battery, including the battery level at certain intervals of time, along with the amount of time it took to drain recently, which is how we measure battery life in laptops at PCWorld.com. The powercfg command can do much more, but I use these two capabilities most often.

Tech Spotlight

A video showcase of the latest trends

Watch the video at go.pcworld.com/lgrobotsvid

LG's robot lineup **for the lazy future**

» LG has integrated Amazon's Alexa into several of its upcoming smart home products to make your life easier—or lazier. Its Smart InstaView Refrigerator has a 29-inch touchscreen so you can see your food, leave notes and more. The Hub Robot can follow you around to take orders or helps you manage household tasks like scheduling your automatic (natch) vacuum.