PC MAGAZINE

the Best of the Year 2018

OUR FAVORITE TECH PRODUCTS

DIGITAL EDITION
DECEMBER 2018

PC MAGAZINE

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FIRST WORD

CAROL MANGIS

2018: A Banner Year for Products

It's hard to believe another year has rolled around since our last "best of the year" story. We've written about some remarkable technology in 2018, including artificial intelligence and its impact on, well, everything; how companies collect your personal data (and how you can keep some of it to yourself); blockchain and cryptocurrency; tech addiction; and how citizen science works in the tech age.

But as you know, our primary focus is on products that you can buy here and now. We test them, review them, and help you use them. And each November, our hard-working analysts take a step (or several) back and think about the most outstanding products they've encountered during the past 12 months.

Altogether, we review a rather stunning 2,500 products a year, so you might think narrowing down that number would be a tough chore. Surprisingly, though, it's not that difficult: The top products tend to stay top-of-mind.

Take a read through this year's story to see what our staff considers the best tech products of the year. Oh, and maybe you'll spot something perfect for someone on your gift list, too.

Know a fitness enthusiast who likes to swim? The excellent—and waterproof—Fitbit Charge 3 might fill the bill nicely. Our reviewer called it "one of the best everyday fitness trackers you can buy." Or

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maybe someone on your gift list hasn't quite dived into the world of smart devices yet but would totally enjoy a smart speaker. Think about introducing her to Alexa via a second-generation Amazon Echo, our top choice. It's a lot more decor-friendly than the original Echo, too.

How about a teen or college student who needs their own TV? You don't have to break the bank: The $650 TCL 55R617 is the best budget television we reviewed this year. It's 4K- and HDR-capable and supports HDR10 and Dolby Vision. Its performance and affordability earned it an Editors' Choice. And any on-the-go music fan would love a set of Jaybird X4 wireless earphones, at just $130. They offer powerful, customizable audio performance, and they're even waterproof.

These are just a few of the 107 best products for the year that's almost over. And as you read this, we're already getting a jump on reviews for 2019. We look forward to the new year and the cutting-edge technology to come.

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When Will Bitcoin Make It Big?

In "Why Bitcoin Is Struggling to Become a Mainstream Currency," Ben Dickson made the case that the cryptocurrency has a long way to go before it's a mainstream method of payment and a major currency. Here's how some readers responded.

Once companies start figuring out they can save huge on banking costs, it will go very fast.
—*Kul*

The issue is that this became a game of fools buying into the idea that [cryptocurrency] is the future. Just like the tulip bulb, Bitcoin became just that—a quick-buck commodity. Then the fools decided they wanted to get rich quick and created the bubble that caused graphics cards to triple in price. Consider the illegal deals; extortion with an untraceable currency makes this a real issue.... [Bitcoin] might have been a good thing, but the bad actors of the world, like always, ruin it for everyone.
—*YouWishYou Knew*

I wouldn't say it's struggling. Progress is marching along steadily. The catalyst that will cause the next major usage spike will probably be another financial collapse. Which, if you didn't know, is primed to happen again in the very near future. The whole market is overbought and inundated with debt. Completely unsustainable as it is. Reset incoming.
—*Servant9*

I love how Bitcoin discussions always refer to traditional currency as "fiat," as though Bitcoin doesn't have even less backing it. I'm not saying that the dollar isn't a fiat currency, mind you, just that cryptocurrency is just as much if not more so.
—*Chara's Dad*

Why would any sane person use a currency whose value is routinely manipulated by speculators? That alone is an adequate reason to avoid the whole scene. And the fact that there are charges for transactions makes it no better than a credit card. Next, the fact that somehow this currency can be created by "miners" running code on computers betrays the whole concept of currency, which is that it is exchanging a symbol of something with actual value for a product or service. Whatever the miners do with their computers does not create physical value, and so it is worthless to me. So perhaps the Bitcoin folks, along with all of our financial weasels, need a good deal more regulation, especially if we want to avoid a repeat of the disaster of 2008, which was the result of inadequate regulation.
—William K

The real problem with cryptocurrency is that it's too difficult for the average person in the street to understand... In times of trouble, people rush to currencies that have an inherent value, such as gold, or backed by an institution that's considered a safe bet at the time... Add to that the growing number of "me too" cryptocurrencies that dilute the market and the sheer unreliability of the providers... Then there is the sheer technical challenge of running a cryptocurrency. It's a pretty inefficient and expensive system to scale (not to mention the environmental cost for the data centers).
—brianN2

Ask us a question!

Have a question about a story in *PC Magazine*, one of the products we cover, or how to better use a tech product you own? Email us at **letters@pcmag.com** and we'll respond to your question here. Questions may be edited slightly for content and clarity.

Are You Ready for the California Consumer Privacy Act?

BY ROB WATTS

Some of the most well-known technology companies are headquartered in California, which on June 28 passed the California Consumer Privacy Act of 2018 (CCPA). The CCPA goes into effect January 1, 2020, and it's expected to affect businesses throughout California, the United States and, in fact, the whole world. The CCPA will impact the way that businesses can handle customer data, and it's considered by many to be the strictest data protection law in US history.

If you're feeling a sense of déjà vu, then you're not alone. Back in May, the European Union's (EU) General Data Protection Regulation (GDPR) went into effect. The GDPR has been a hot topic here at PCMag. While the law was made across the Atlantic, the truth is, it's made a mark on businesses worldwide because it applies to all EU citizens regardless of where they live. Much like the GDPR, the impact of the new CCPA will have far-reaching implications beyond the scope of its origin state. We talked to a few experts to learn more about the CCPA and some what to expect.

THE CCPA AND YOU: AN INTRODUCTION

The CCPA establishes a consumer's right to request that businesses disclose what sort of data is gathered about them. Unless you're using a tool such as a virtual private network (VPN), it's pretty much a certainty that countless businesses are gathering information about you whenever you're online. To say this sort of transparency that the CCPA will bring is a big deal would be an understatement.

The CCPA establishes a consumer's right to request that businesses disclose what sort of data is gathered about them.

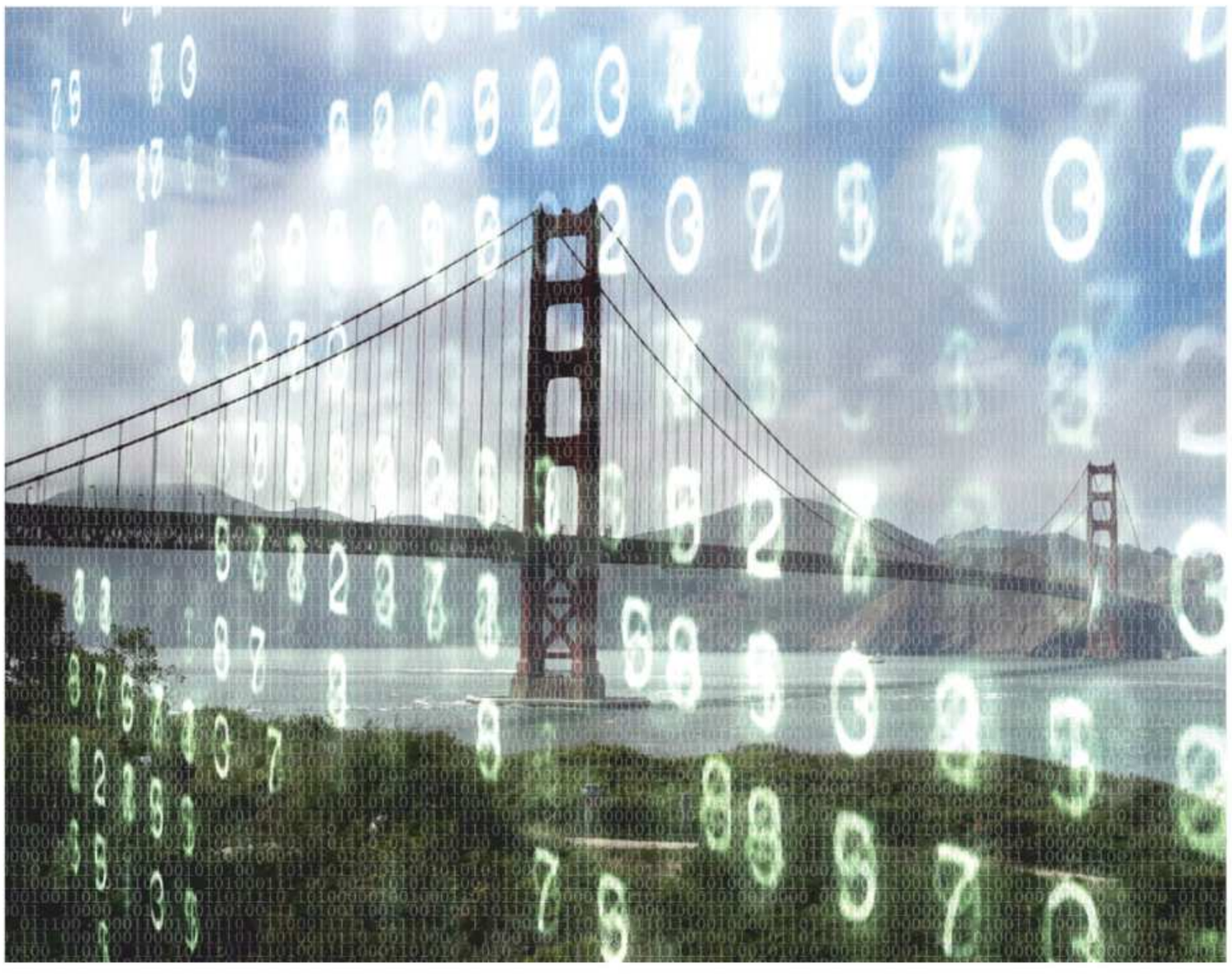
John Tsopanis is a Privacy Product Manager at 1touch.io, a company that helps businesses understand the personal data they handle. Tsopanis has spent the past few years doing GDPR consulting for companies and is gearing up to do the same with the CCPA. Tsopanis explains the CCPA in basic terms.

"On Jan. 1, 2020, a California resident will have legal right to ask any big company in America: 'Are you processing any of my information?'" Tsopanis said. "Within 45 days, that company will be obligated to reply with a report detailing the last 12 months. It will have to show what specific categories of personal information they have on that individual, who they are sharing it with, and what are the reasons for processing it. They need to give that information to California residents—all 40 million of them—within the timeframe."

DIFFERENCES BETWEEN GDPR AND CCPA

There are some substantial differences between what the GDPR does and what the CCPA covers. For starters, the CCPA will use an opt-out basis for consent whereas the GDPR uses an opt-in basis. This essentially means that users will have to actively reach out to companies to find out about what sort of information is being used. Additionally, the GDPR applies to any organization that holds personal data on EU citizens.

The CCPA, on the other hand, only applies to for-profit companies that process data on California residents. The organization must either do at least $24 million in annual revenue, hold the data of 50,000 people, or do at least half of their revenue in the sale of personal data. So, if you own a small boutique store and the extent of your online operations is a webpage that lists your store hours and address, then you won't have to worry too much about the CCPA. But if you run an e-commerce website through a turnkey provider or maintain your own e-tail website through a general web hosting service, then you'll want to pay attention.



“Users will have to actively reach out to companies to find out about what sort of information is being used.”

Courtney Bowman is an associate in the litigation department at international law firm Proskauer Rose LLP. Bowman explains why the CCPA will require companies to think carefully about their data usage far beyond 2020. “That 12-months requirement means that companies are going to have to look at their privacy policy at least once a year and try to figure out whether anything’s changed,” she said.

“They’re going to have to continually monitor what data they’re selling or disclosing to third parties so they can adjust their privacy policies accordingly,” Bowman continued. “The law also gives consumers a right to access or delete their personal information in some situations, and businesses will need to ensure that they can actually effectuate that right expeditiously. That’s going to require companies to engage in data mapping to figure out where their data is located, and also to liaise with their IT departments to figure out what they need to do to make sure that they can fulfill their responsibilities under the act.”

THE CCPA’S WIDE IMPACT

In the months leading up to the GDPR, a running theme in our coverage was that, in our globalized world, the GDPR would affect businesses beyond Europe. After all, most large companies do business abroad and will have to change their online operations globally to comply with the law. When we spoke with Tsopanis, however, he said American companies still need to take special notice of the CCPA.

“When it comes to American companies, the GDPR was mainly focused on major organizations that were operating across the channels. With the [CCPA], the criteria for the companies that qualify is much larger by a massive order of magnitude,” said Tsopanis. “There are 40 million people in California; 50,000 isn’t even 0.1 percent of the population. I think the scale of exposure for American companies is significantly higher than was previously under the GDPR.”

Tsopanis offers the example of fast food giant Wendy’s. “Wendy’s is the 999th largest company on the Fortune 1000 and has an annual revenue of $1.2 billion—48 times higher than the threshold for applicability under this law. At the very least, there are 1,000 billion-dollar companies in America [that] need to comply with this law, and significant orders of magnitude greater than that in the $25-million category.”

We may not consider Wendy's a tech company, but it gathers a fair share of user information. It is also a perfect example of how companies of all kinds will be affected by the CCPA. When you visit Wendy's website, order food via its point-of-sale systems, or even just use the Wi-Fi at your local Wendy's restaurant, the company is collecting your information. And in California, at least, that'll all be subject to CCPA regulation. If a company as "small" as Wendy's is collecting so much data on users, then it's downright scary to think of what larger corporations are collecting. Simply put, the CCPA will have enormous implications.

We may not consider Wendy's a tech company, but it gathers a fair share of user information.

IMPORTANT DATA DISCOVERIES

One of the most important effects of the CCPA is that Americans will finally be able to uncover the vast amounts of data buying and data selling that companies have been doing. "This bill is going to allow the American people to finally uncover the mass web of data buying and selling organizations [that] have previously been completely anonymous. This is going to lead to a dramatic cultural shift in the way data privacy is perceived,and, ultimately at some point, lead to harmonized federal privacy law," Tsopanis said.

When the Cambridge Analytica scandal broke, it got the attention of millions of people, whether they were technologists or not. It made people very concerned about who's collecting their information and what is done with it, and the CCPA is, in part, a response to that. Tsopanis argues that the resulting revelations will be massive.

> **Americans will finally be able to uncover the vast amounts of data buying and data selling that companies have been doing.**

"For every journalist in the country, this is a godsend. California is a $2.7 trillion economy—the fifth largest in the world—and it is built on Big Data. Every access request from every Fortune 1000 company is going to reveal a whole network of data buying and selling companies that are going to come under intense scrutiny," Tsopanis explained. "We don't know exactly what we'll find when folks start getting their data reports, but there are sure to be some interesting revelations."

JUST 18 MONTHS TO PREPARE

If we learned anything from GDPR, it's that companies need to plan as early as possible to be ready for the deadline. With that in mind, American companies don't have much time at all. The GDPR was adopted in April 2016, and companies had a little over two full years to adapt and comply with the regulation. Since the CCPA goes into effect right at the beginning of 2020, this means larger companies now have just 18 months to get ready.

That deadline is likely to stress out even the most seasoned tech professional. "The amount of work that needs to be done in 18 months is greater than was necessary for the GDPR, with less time to do it, and with American companies coming from a lower level of privacy maturity than Europe," warns Tsopanis.

To comply, the security veteran recommends companies take proper care in developing their processes. “In the next six months, what organizations need to do is to develop some sort of method of tracking personal information across the organization,” Tsopanis said. “They need a way to easily access what personal information was sent to which third party and at what time, and then they need to be able to track that over the 12 months up to implementation, and be ready to provide that information upon request when the regulation comes into play.

“It is essentially going to require almost all major US companies to conduct major data identification activities and to be able to automate and respond to data subject access requests from California residents on the enforcement date,” Tsopanis continued. “It’s also important to note that, when the law passes in 2020, they need to be able to provide a report on user information in the preceding 12 months. This effectively means that businesses need to be tracking that data on January 1, 2019.”

From a legal perspective, Bowman says, there could be some changes made before the deadline. “We do expect that we’re going to see some revisions to the law before it goes into effect,” she said. “Because it was drafted fairly quickly, even after it goes into effect there may be some gray areas that remain outstanding in terms of our understanding of them. After all, the GDPR took years to draft, and there are still multiple parts of the GDPR that are ambiguous.”

“It is essentially going to require almost all major US companies to conduct major data identification activities.”

Astronaut Mae Jemison on the 'Adrenaline Rush' of Space Travel

BY CHANDRA STEELE

Season two of the National Geographic Channel's *Mars*—which is part drama and part documentary—explores what it would take to survive on another planet.

The speculative show comes courtesy of producers Ron Howard and Brian Grazer, who have already given us a vivid picture of the space race with *Apollo 13*. At the heart of the fictional *Mars* is the International Mars Science Foundation (IMSF), an organization formed by the world's space agencies and private industry.

Season one took place in the year 2033 and depicted the first human mission to Mars, with an Elon Musk–like character leading the effort. Season two tackles how the crew survives.

The real-life challenges that the fictional future faces are handled as flashbacks of our current efforts to send a mission to Mars: SpaceX landing the first reusable rocket, astronaut Scott Kelly living aboard the International Space Station for a year, and scientists in Antarctica developing a blueprint for Mars settlements. This footage is interspersed with talking-head commentary from Elon Musk, Andy Weir, Robert Zubrin, Neil deGrasse Tyson, and others who influence our thinking and planning of journeys to Mars.

“The challenges that the fictional future faces are handled as flashbacks of our current efforts to send a mission to Mars.”

Even when *Mars* turns toward fictional drama, it’s based in facts—like the extraordinary amount of radiation a crew to Mars would experience and the bone density they’ll lose before they even reach the planet. That’s thanks to experts like astronaut and physician Dr. Mae Jemison, who advised on the show.

Dr. Jemison, the first African-American woman to go into space, also shared her expertise on *One Strange Rock*, another Nat Geo production. For *Mars*, she got involved with educating the writers and guiding the actors. At an event celebrating the kick-off of Season two, Jemison said she did not want those watching to be taken out of the action by anything that would read as unrealistic on screen, so she used her medical knowledge to make sure injury and illness on Mars took into account the forces of physics in space.

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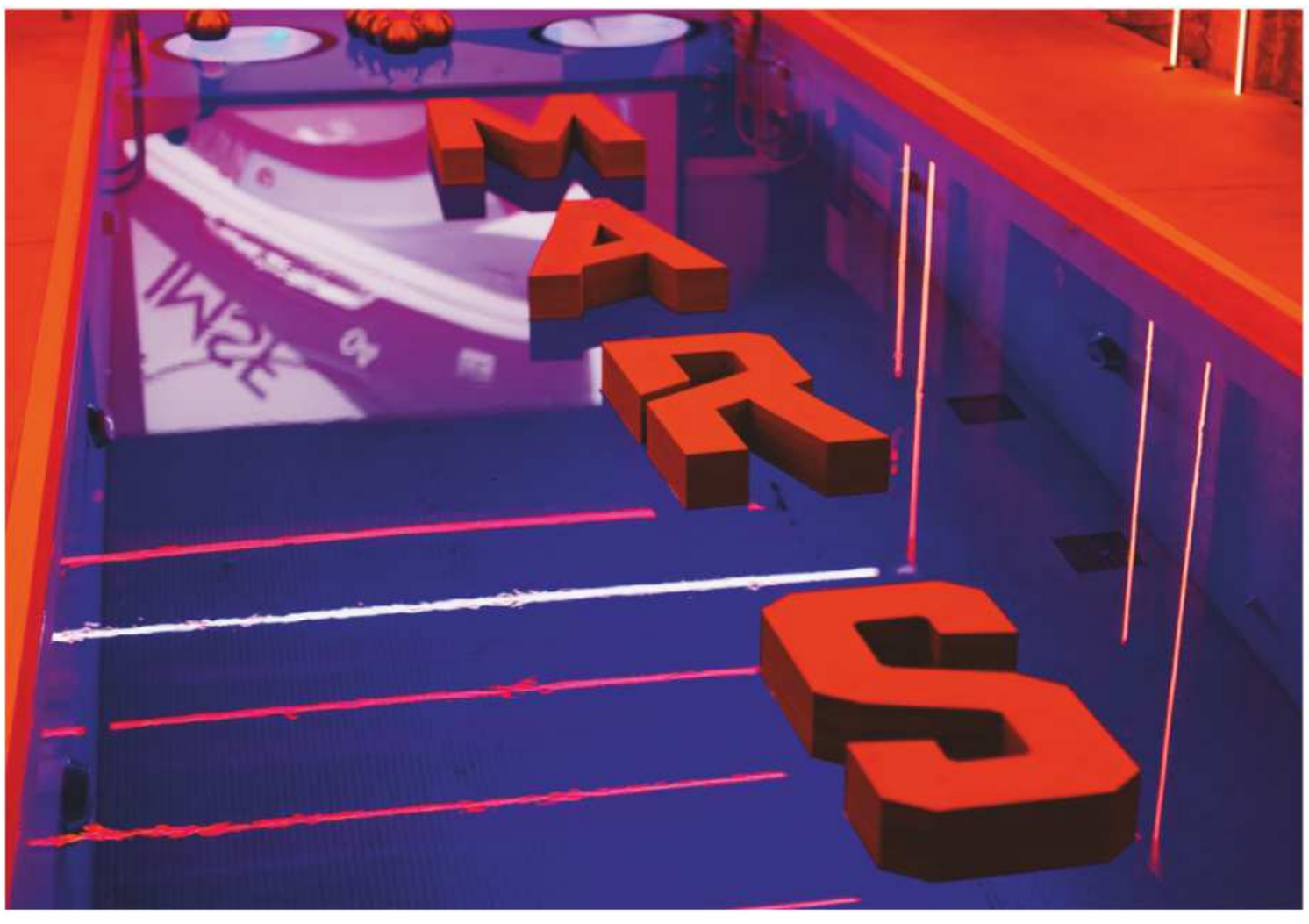
"Audiences internalize a lot of what they see and so [we wanted this to be] as educational as possible," Dr. Jemison said.

The series is based on the book *How We'll Live on Mars*, by Stephen Petranek. While the book lays out the serious challenges a Mars colony would face—the size of the planet (half that of Earth), the unlivable temperature (-81° F), the unbreathable atmosphere (carbon dioxide), the difference in gravity (38 percent less than Earth's)—it puts a lot of the responsibility for getting to the Red Planet on Elon Musk.



By contrast, *Mars* the TV show does a good job of showing that actual Mars habitation will involve international cooperation and a reliance on decades of publicly funded research. Though we live in an increasingly fractured and fractious world, Dr. Jemison pointed to the International Space Station and international scientific conferences as proof that people can work together.

To ensure that today's astronauts get an opportunity to travel even farther than she did, Dr. Jemison heads 100 Year Starship, a DARPA and NASA effort that supports research into interstellar travel. One of her concerns is that the public is no longer galvanized to support the space program the way it was when John F. Kennedy declared, "We choose to go to the moon."

"I should have been on Mars," said Dr. Jemison.

Ultimately, it's how we act on Earth that will determine whether we get to Mars. "Humans need an adrenaline rush," Dr. Jemison said. "The way people are trying to get adrenaline now is by frightening and war. But look at all the adrenaline that happens when you try something that you don't know how to do. You don't have to beat or abuse somebody else to get that same endorphin or adrenaline rush, so let's come up with new things, let's see how we're connected."

Dr. Jemison heads 100 Year Starship, a DARPA and NASA effort that supports research into interstellar travel.

Why PC Builders Should Stock Up on Components Now

BY MICHAEL KAN

NZXT is a popular PC desktop case vendor, but the California-based company recently had to raise its prices. The reason? The new US tariffs on Chinese imports include PC cases.

In September, the Trump administration imposed the 10 percent duty, which also covers motherboards, graphics cards, and CPU coolers from the country. As a result, NZXT had to introduce a 10 percent price increase on PC cases to deal with the added costs, VP Jim Carlton told PCMag in an interview.

And building a PC could get even more expensive in 2019; US tariffs on Chinese-made goods will rise from 10 percent to 25 percent in January.

"If I needed to build a system in the next six months, I'd definitely build it before the end of the year," Carlton told us.

FOOTING THE BILL

For PC builders, the tariffs risk adding a few hundred dollars to the total cost of components for a custom desktop. “If it’s a $2,000 purchase on 25 percent tariffs, it’s going to be a $2,500 purchase,” Carlton said. “So we are very concerned with the direction of where this is going.”

“I don’t have a 10 percent [profit] margin I can just throw away and absorb the tariffs,” he added. “And certainly no one has a margin for 25 percent.”

But retail consumers won’t be the only buyers affected by the tariffs. MBX Systems is another US provider of hardware systems, which focuses on enterprise customers. The Illinois-based company specializes in assembling servers, which are then resold by its clients, such as cybersecurity firms.

Last month, the company told its customers the bad news: More than 30 component suppliers—including Intel, Samsung, and Seagate—had been affected by the tariffs, forcing server component costs to go up.

“For PC builders, the tariffs risk adding a few hundred dollars to the total cost of components for a custom desktop.”

"We've seen anywhere from reluctant acceptance by the customer—where they're not going to increase the cost to the end user—to others that will push back heavily," MBX Systems president Chris Tucker told PCMag.

Part of the pushback is due to the way the enterprise market works. Buyers of MBX System servers can end up signing contracts with their own clients to provide the hardware—but at a fixed cost, prohibiting any future price increases for the duration of the contract.

Chris Tucker, president of MGX Systems

Clients "are going to have to make a choice: either change the pricing structure or choose to eat the costs," Tucker said. "We've seen people do both." But he expects that to change when the 25 percent tariff goes into effect. Customers will then have no choice but to consider price increases.

TRYING TO STOCK UP

To avoid the added costs, US retailers have been stockpiling PC components that were imported into the country before the tariffs went into effect. As a result, consumers might not encounter any price hikes online just yet.

For instance, pre-tariff PC cases made by NZXT are still moving through the sales channels, Carlton said. Retailers such as Amazon and Newegg also like to maintain large inventories on PC parts. To meet holiday demand, vendors usually start shipping PC components into the country in July, months before the tariffs went into effect, he added.

But pre-tariff inventories will eventually run out. What then?

Some suppliers have been shifting certain manufacturing activities away from China, Nvidia told PCMag. The company didn't go into detail, but an Nvidia spokesman said manufacturing has been moving to areas like Taiwan—home of several motherboard and graphics cards makers such as MSI, Asus, and Gigabyte.

But leaving China isn't a near-term solution for every vendor. "We have been looking outside of the country for factories, but we can't save much cost versus what we save in China," Carlton said. Factories elsewhere are less efficient and can end up adding 5 to 10 percent in manufacturing costs over China.

"Even if we wanted to do manufacturing in the US, it would take years of investment to get the infrastructure," Carlton added.

That may have been one of the implicit goals of the Trump administration's decision to issue the tariffs: to bring manufacturing back to the US. How feasible this is has been debated over the years. But in the meantime, hardware providers fear the coming price increases will slow sales—especially when the tariffs rise to 25 percent in January.

"It's not adding anything of value to our customers," said MBX System's Tucker, who said the tariffs have also been consuming the company's time. "We have probably spent hundreds of hours managing the price changes," he added. "If I'm going to boil this down, it's a pretty heavy labor tax on our organization."

LITTLE GUYS GETTING HIT HARDER

There is an important catch with the tariffs; they cover only PC components, not finished desktops or laptops from China. That's good news for average consumers who just want to upgrade their PCs. But it's a problem for smaller PC dealers who import components from China and assemble the hardware in the US.

Linn Huang, an analyst at research firm IDC, said it's too early to tell what kind of impact the tariffs are having on the market. Nevertheless, the potential price increases risk making it "unsustainable" over the long-term for smaller hardware vendors in the market, he said.

Big-name vendors "don't like the tariffs, but they can weather them. They can stomach them much better than the little guys," Huang said. "Hardware margins are already razor-thin as they are."

Cyberpower, a US-based company that assembles gaming PCs, warned as much back in September. “In our company’s 20-year history, the proposed Section 301 Tariff Action is the greatest threat to our company’s survivability to ever arise,” Cyberpower said in a public letter to US trade authorities.

“As a small business, we are already facing tremendous pressure from large global manufacturers like HP/Dell/Apple, which [have] a greater capacity to absorb these increased costs from the new tariffs,” CEO Eric Cheung wrote.

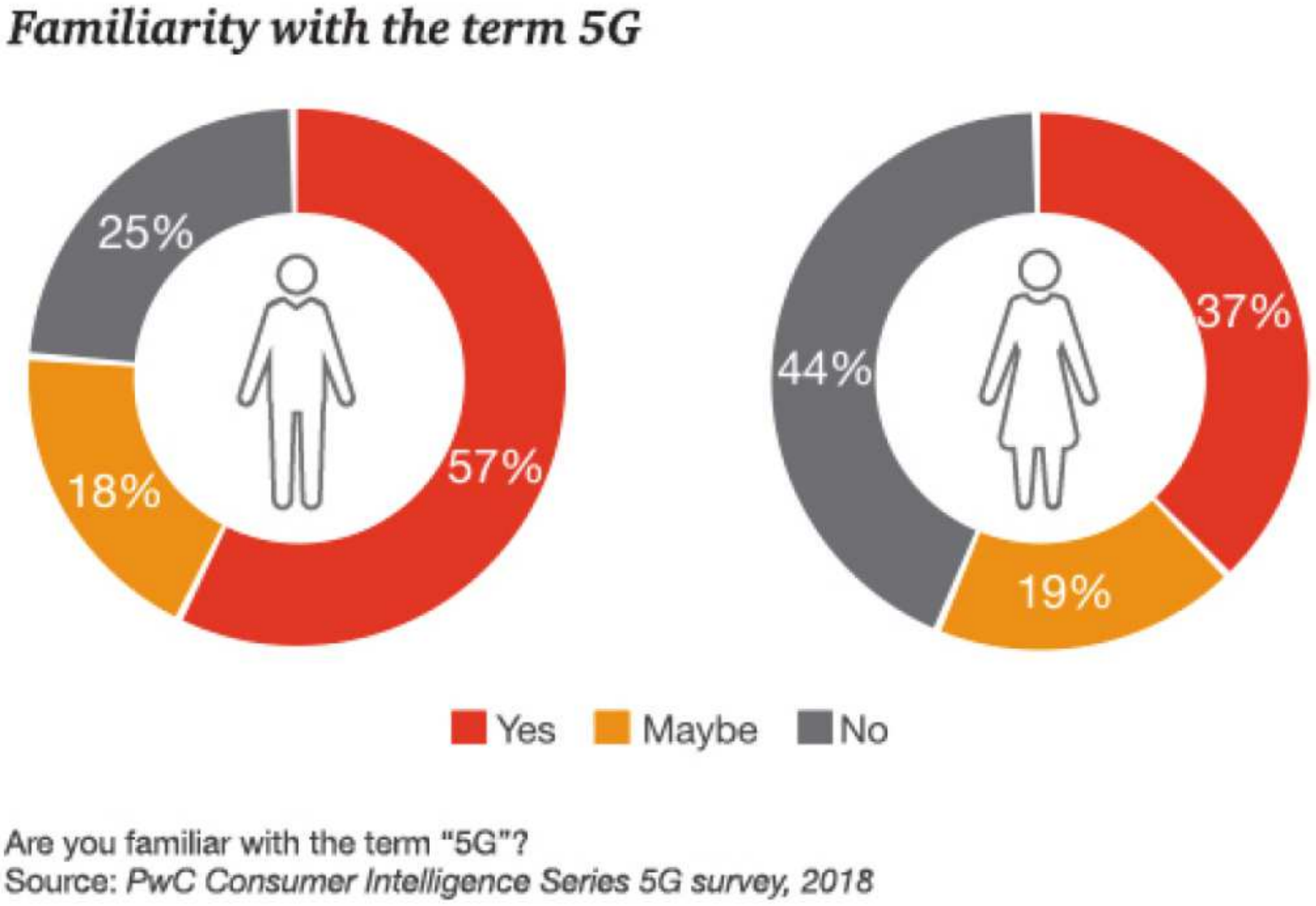
In the meantime, retail consumers can still find PC components at pre-tariff prices online. But buy them while supplies last.

“All of us are trying to absorb the costs. We don’t want to punish the American consumer if we don’t have to,” NZXT’s Carlton said. “But at some point, it becomes a fundamental issue about if you can keep your business moving forward.”

Retail consumers can still find PC components at pre-tariff prices online. But buy them while supplies last.

Most People Don't Even Know What 5G Is

BY ANGELA MOSCARITOLO

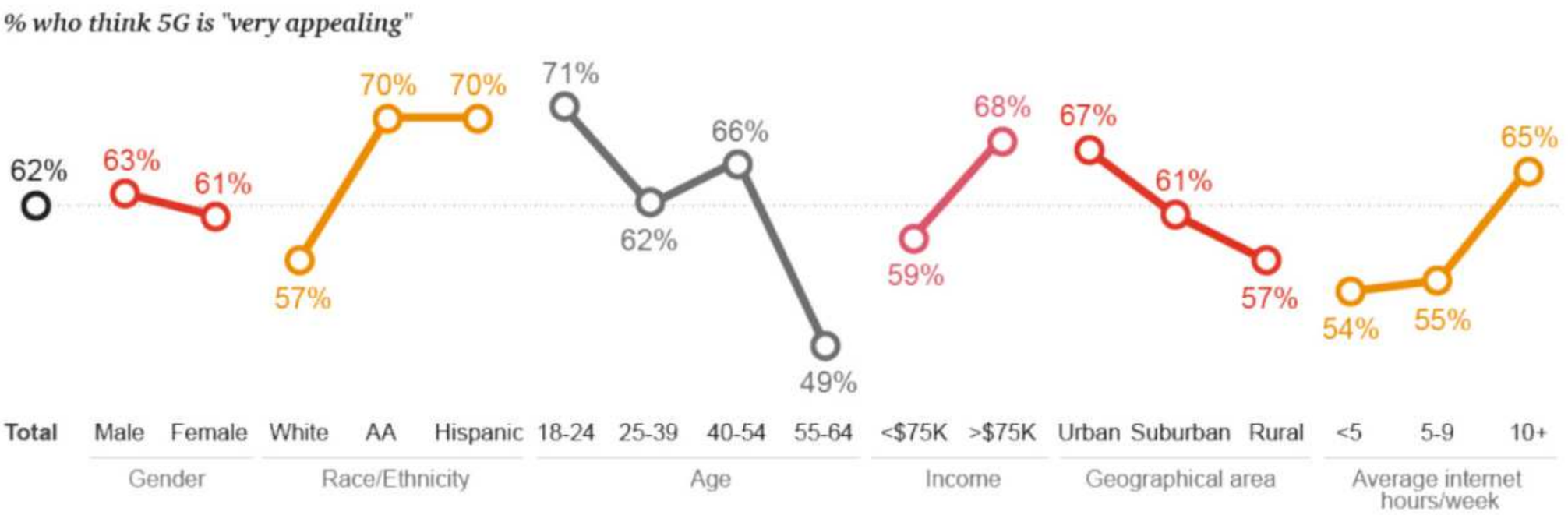


Are you familiar with the term "5G"?
Source: *PwC Consumer Intelligence Series 5G survey, 2018*

Carriers are starting to make a lot of noise about 5G. But do consumers really care?Well—not so much, at least not yet. A new survey from PricewaterhouseCoopers reveals that most people still don't even know what 5G is.

Just 46 percent of the 1,000 US internet users ages 18 to 64 who were polled by PwC last month were familiar with the term "5G." Awareness was highest among males and those living in urban areas.

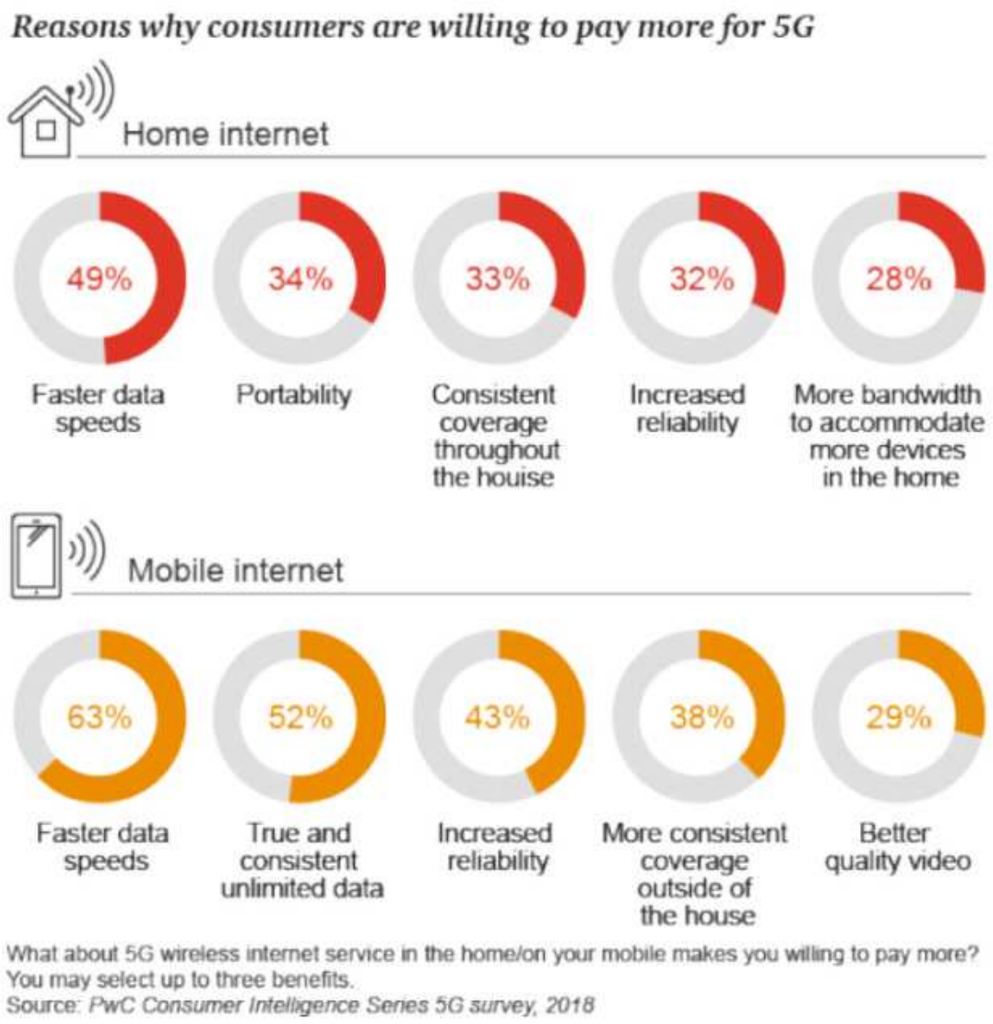
But when they learn that 5G—the next generation of wireless network technology—is expected to deliver faster data speeds, lower wait times, and improved reliability and may become a replacement for their home internet, consumers are into it. "Nearly everyone" surveyed found the idea of 5G appealing; 62 percent called it "very appealing."



Based on the above description, how appealing is 5G to you?
Source: *PwC Consumer Intelligence Series 5G survey, 2018*

About a third of respondents find the promise of 5G so appealing that they would pay extra for it. On average, those consumers would be willing to pay an extra $5.06 a month for 5G service in their homes and an additional $4.40 a month for it on their mobile devices.

“More consumers are willing to pay a premium for 5G in the home than on mobile,” PwC wrote in its report. “As it is, home internet users are less satisfied with their current service, and they feel as though they are already overpaying.”



What about 5G wireless internet service in the home/on your mobile makes you willing to pay more? You may select up to three benefits.
Source: *PwC Consumer Intelligence Series 5G survey, 2018*

Even so, most people are in no hurry to get 5G, PwC found. Just 26 percent said they would buy a new 5G-compatible device as soon as their wireless provider started offering the service in their area, even if they weren’t yet eligible for an upgrade. The other 74 percent said they would ride out their current contract before upgrading.

All four major US carriers—Verizon, AT&T, Sprint, and T-Mobile—have said they’re launching 5G either this year or early next. Verizon recently launched its 5G home broadband service in parts of four major US cities, AT&T expects to hook up mobile 5G in parts of a dozen cities before the end of the year, and Sprint and T-Mobile intend to debut the service early next year.

Sascha Segan

COMMENTARY

Can USB-C and Photoshop Make the iPad Pro a PC?

The iOS laptop is already here: It's the new Apple iPad Pro. With a real USB-C port and some key pro software, this iPad is finally providing a real test of whether a third OS can join macOS and Windows for true professional work.

Apple has been pushing the idea of productivity on iOS for years, with limited success. When the little girl in the Apple ad asked, "What's a computer?" she reflected a now-common Gen-Z way of being creative: producing their work end-to-end on a "mobile" OS. I've seen the same workflow used by my 12-year-old daughter, who's taken to creating and editing movies on her Samsung Galaxy Note 4.

But take those kids into the grownup world, and they still need grownup OSes. That's not, by and large, about computing power. The latest Apple and Qualcomm chipsets are perfectly capable of managing your average corporate workflow, as we've seen on the Qualcomm Snapdragon 850-powered Samsung Galaxy Book2. They aren't workstations, but most people don't need workstations.

Sascha Segan is the lead mobile analyst for *PC Magazine*. His commentary has also appeared on Fox News, CNBC, CNN, and various radio stations and newspapers around the world.

Instead, the issue is about iOS's philosophical core, which is as a single-window, unitasking operating system. Professional workflows generally require massive multitasking, juggling various windows and documents for cutting and pasting and inputting and outputting lots of data. The new 2018 iPad Pro will have "real" Photoshop in 2019 and enough Microsoft Office functionality to get the job done. It works with desktop peripherals now. But it still isn't a juggler, and at work, well, we juggle.

USB-C OPENS UP THE IPAD

A pro computer may need a keyboard, printer, monitors, cameras, peripherals, and storage. USB-C allows for all of that, probably via docking stations that turn a mobile iPad Pro (or one with a keyboard) into a quasi-desktop.

The iPad has been slowly accumulating all of those peripherals over time, mostly wirelessly. Being able to hook up to a wired workstation setup, though, is much more convenient and opens up a wider variety of less-expensive peripherals. Especially for people whose work is mostly in touch-focused applications—people who draw with the Pencil in Photoshop, for instance, or who mix music—USB-C lets the iPad sit at the center of their desk instead of off to the side syncing files with the "real" computer.

Take photography, for instance. USB-C lets a photographer connect their camera to the iPad, edit files in Photoshop, and then offload the files to a giant hard drive. A designer could hook up to a big monitor at their desk and then take the iPad along for presentations.

It isn't going to be the same workflow as you have with a Mac. Because the iPad doesn't support a trackpad, you're likely to have the iPad flat on your desk (or propped up with a keyboard) with a type-and-tap flow, as opposed to mouse or trackpad. Still, though, that's really offensive only if you're an old person whose muscle memory is really fixed on mice and trackpads, like I am. There isn't anything necessarily less efficient about tapping and dragging on a screen than about swinging a mouse around.

No, the iPad's trouble, as always, has been deep in the core of its OS.

IOS HAS A MULTIFINDER PROBLEM

Here's a throwback for Mac fans: iOS has the MultiFinder problem.

The first 15 years' worth of Mac operating systems had problems with multitasking. Since they weren't designed for it, a succession of kludges were tacked on over the years to try to get programs to play well together. (This isn't unique to the Mac—it was true about Windows before Windows 95, as well.) The Mac needed a complete OS overhaul, with Mac OS X, to truly introduce modern multitasking.

Apple's iOS was, at its core, designed as a single-window operating system with a non-user-accessible file system. That philosophy is pretty deep in iOS, and it works really well in certain contexts—for instance, on a handheld device that needs a really strong security model, like the iPhone. But as you're pushing toward handling a lot of programs and files at once, things start to get really unwieldy because iOS wasn't designed to juggle a lot of programs and files at once.

> **USB-C lets the iPad sit at the center of their desk instead of off to the side syncing files with the "real" computer.**

Sascha Segan

Apple adding limited multi-window support and the Files app in iOS 11 reminds me a lot of how Apple integrated the functionality of MultiFinder into the seminal System 7 release of macOS. That was a great leap forward for Mac capabilities, but it was still a clunky way to juggle tasks.

This is where people will get frustrated. If you only ever work in one app, like Photoshop or Illustrator, I can see this iPad workflow working out. But if you're copying and pasting between Word, PowerPoint, and web windows, drumming up Excel charts to paste into Google Docs, or receiving and reformatting a range of clips and files from a bunch of different sources, well, that's still going to be frustrating. It's just not what iOS was designed for.

The iPad Pro is a truly powerful piece of hardware. With USB-C, it has the flexibility to connect to PC-class peripherals. But until it can easily use three different apps at the same time to input and output data from a range of sources all at once, it just won't be a Mac.

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If you only ever work in one app, like Photoshop or Illustrator, I can see this iPad workflow working out.

COMMENTARY

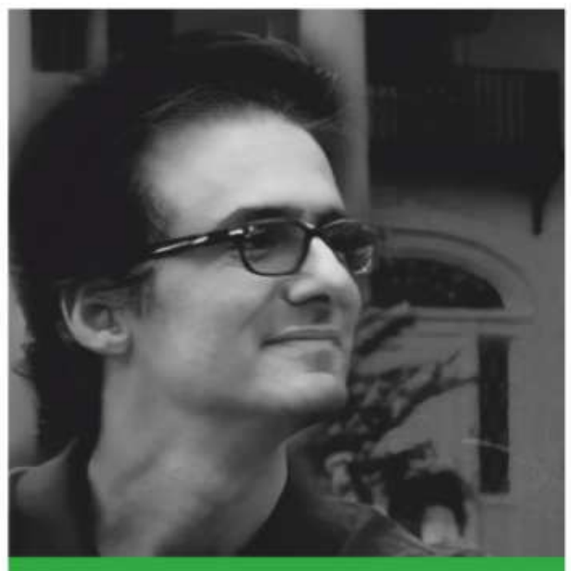
Why Passwords Might (Finally) Go Away

In 2012, *Wired*'s Matt Honan wrote about the disastrous consequences of tying your entire digital life to a string of letters, digits, and symbols. Honan is just one of countless people whose online accounts were hijacked after hackers discovered their passwords; the list of victims also contains high-profile tech executives, including Mark Zuckerberg.

For years, we've been talking about the need to replace passwords with more secure and reliable methods. As recently as last month, the United Nations accidentally revealed employee passwords on publicly shared Trello boards and in Google Docs. Even Facebook's recent hack was related to poor password-based authentication systems. And billions of stolen passwords are changing hands in dark-web markets.

And yet, passwords remain the main method of protecting online accounts.

There has been no small amount of innovation in the authentication space. In 2016, I wrote about authentication technologies that provided secure and easy-to-use alternatives to passwords, but until recently, none had achieved mass adoption.



Ben Dickson is a software engineer who writes about disruptive tech trends, including artificial intelligence, VR and AR, the IoT, and blockchain. Ben also runs the blog Tech Talks.

Now, though, there's hope that we can finally ditch long, complex passwords thanks to a series of regulations and open standards that ease and encourage the implementation of passwordless authentication methods in online applications.

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WHAT'S PREVENTING PASSWORDLESS AUTHENTICATION?

"The vast number of passwords needed in our daily lives have become a burden, which is why we see so many reused or weak static credentials," says Stina Ehrensvard, CEO and Founder of Yubico, which manufactures physical security keys such as the Yubikey 5 NFC. "We needed to think about how to address this problem in a way that simplifies the login process while adding the highest level of security. Up until now, there hasn't really been a way to do both of those things successfully."

The vulnerabilities of passwords are not lost on the organizations that continue to use them. But before considering alternatives, they must take into account the security, usability, availability, and costs of the technology.

"The reason we haven't replaced passwords before now with something more reliable is that all the alternatives that may have been better for security or usability have not been ubiquitously available to all shapes and sizes of internet-connected devices, nor have they been cost-effective," says Brett McDowell, executive director of the FIDO Alliance, a consortium that develops authentication standards.

Also, password entry is the least expensive and easiest authentication technology to implement in

new websites and mobile apps. And while alternatives such as biometric authentication technology have become more widely available on mobile devices, password entry remains the ubiquitous feature that all devices support. Removing it would prevent many users from accessing those services.

Lack of standards also makes it hard to move away from passwords. The overhead cost of adding support for dozens of different authentication technologies in client applications and backend servers is something that most organizations could not bear.

And of course, there's always the human factor. "Some companies and individuals continue to believe that they won't be affected by cyber attacks and that they are not of interest to cybercriminals. A lack of desire and resources to change existing solutions is hindering adoption of new passwordless authentication solutions," says Alex Momot, CEO of REMME, a startup developing a decentralized authentication system.

THE FEDS COME KNOCKING

In recent years, there's been an increase in awareness surrounding online security and privacy of users, especially among government agencies and regulators. While previously, organizations could've shrugged off data breaches and security incidents with few legal and financial consequences, that's no longer the case.

"Regulators are as tired of data breach headlines as anyone else, and they are starting to take action, resulting in more businesses adding strong authentication to their data protection practices," says McDowell.

Among the most relevant regulatory actions is the General Data Protection Regulation (GDPR), a set of rules that define how companies collect, handle, and secure user data. GDPR also defines standards for strong user authentication. Companies that fail to comply with the rules and protect their customers' data will be severely fined. GDPR applies to the EU jurisdiction only, but since many companies that aren't based in the EU still do business in the region, it is now considered a gold standard for security.

“At a time when more and more companies are adopting strong authentication, and more and more data breaches are caused by password compromise, it is going to be increasingly difficult for a business to make the case to a GDPR regulator that password-only authentication is appropriate security, potentially exposing their company to fines that are far more expensive than the price of moving from passwords to true strong authentication,” McDowell says.

Other industry-specific regulations are more explicit about the use of authentication technology. An example is Payment Services Directive 2 (PSD2), which regulates e-commerce and online financial services in Europe and makes two-factor authentication (2FA) mandatory. PSD2 also encourages the use of security cards, mobile devices, and biometric scanners to improve the user experience without compromising security.

And the National Institute of Standards and Technology (NIST), which defines the criteria for various industries, states in its digital identities guidelines that organizations should move away from passwords and one-time passcodes and adopt modern strong authentication.

“More specifically, NIST recommends authentication in which your modern device creates and uses cryptographic private keys as your new account credentials and securely stores them to your personal device in the same way most smartphones now securely store your fingerprint data,” McDowell says.

There’s debate over whether government regulation will hamper or encourage innovation. But at this point, we might need a regulatory push toward the adoption of more secure authentication mechanisms.

“Governments can play a critical role in the adoption of open standards,” says Ehrensvard. “Take a look at the seatbelt, for example. It too is an open standard, and its use was regulated by the government. Because of this, there are 10 times more cars on the road today but a lower total number of fatal car accidents.”

GETTING ON THE SAME PAGE

Widespread replacement of password-only authentication needs more than regulations. Without a set of standard protocols, organizations and companies will struggle to find an authentication technology that keeps them in line with security regulations while making their applications available to their users.

That was the problem FIDO was set to solve. FIDO Authentication is based on a set of free and open technology standards, developed in partnership with the World Wide Web Consortium (W3C). The aim is to create interoperability among devices and services by enabling the entire consumer electronics industry to integrate the technology into their products and platforms.

“Widespread replacement of password-only authentication needs more than regulations.”

FIDO replaces passwords with public key cryptography. This means that instead of passwords, users are identified with a pair of public and private keys. Anything encrypted with a public key can be decrypted only by its corresponding private key. When a user signs up with an online service that supports FIDO authentication, the service generates a key pair and stores the public key on its servers. The private key is stored on the user’s device only. When logging in, the client application is presented with a cryptographic challenge generated with the public key, which can only be solved by the private key. Users must verify their identity with their device (through fingerprint, face, or PIN) to unlock their private key and solve the challenge.

The advantage of this model is that it provides multi-factor authentication without requiring the storage and exchange of passwords. Even if hackers manage to breach the servers of the service provider, they'll get access only to public keys, which are useless without the corresponding private keys stored on users' devices. If the hackers steal a user's device, they'll still need to bypass the local identity verification to obtain the private key. From a user's perspective, this obviates the need to memorize long, complex passwords for each account while providing superior security.

But FIDO's greater achievement is getting widespread support from the tech industry. The alliance has brought together big names such as Google, Microsoft, Amazon, and Intel to develop standards that would be easy to implement on different device types and operating systems.

"The businesses that came together to form FIDO Alliance understood that replacing passwords for online authentication could only ever become commercially viable at scale through a combination of free and open technology standards, a vastly superior user experience, and a fundamentally different approach to the security model," McDowell points out.

FIDO recently released the FIDO2, an extension to its standard which adds support for public key authentication to browsers and a wide range of application frameworks. The standard is supported by Windows 10, Google Play Services on Android, and the Chrome, Firefox, and Edge web browsers. WebKit, the technology behind Apple's Safari browser, might also add support for FIDO2 soon.

"The FIDO2 standard enables the replacement of weak password-based authentication with strong hardware-based authentication that utilizes public key cryptography," says Ehrensvard, whose company Yubico is among the key members of FIDO. "This standard allows for passwordless authentication in several forms, including via USB and tap-and-go NFC, which provides an optimal user experience, and drastically improves security and productivity."

WHEN WILL PASSWORDS FINALLY GO AWAY?

Although the industry has come a long way toward developing alternative authentication methods, passwords won't disappear overnight. "We should take into account that we have a lot of 'legacy' software and information systems. That's why it's not always possible to easily change established rules of authentication including those that are password based," says Momot, the chief executive from REMME.

Other experts such as Sandor Palfy, CTO of LogMeIn, believe passwords will remain a central facet to identifying users. He also believes the industry should focus on improving the password experience.

"Until universal coverage with multi-factor authentication (or even behavioral or contextual authentication) is available, companies need to invest in strengthening password-protected services in use across the entire organization," Palfy says.

"Remembering unique, complex passwords for all our work and personal accounts doesn't align with natural human behavior. By using tools like password managers, remembering multiple passwords should be a thing of the past, with users only having to remember one master password," says Palfy, whose company is the developer of the LastPass password manager.

But to McDowell, who has been at the helm of FIDO since 2014, the quest to root out passwords is finally reaching its final stages. "Today the passwordless future is becoming a reality, one application at a time. Within a few years, I expect password entry forms to be about as rare to find on web pages as public telephone booths are in public spaces these days, and for the same reason—we have a cost-effective, ubiquitous alternative that offers a much better user experience," he says.

Tom Brant

COMMENTARY

Apple's New Mac Mini Kills the Entry-Level Mac

Macs are expensive. As if to reinforce this universal maxim, the last remaining bastion of Apple affordability evaporated into the crisp fall air in New York City, as Apple CEO Tim Cook unveiled a brand-new Mac mini.

The old $499 Mac mini, a tiny desktop PC that is sold without a monitor or peripherals, was the least expensive entry point into the macOS ecosystem. Its replacement gets a slew of overdue improvements—the Mac mini's last refresh was in 2014—but also a $300 price increase, which takes it far out of the realm of affordable desktops.

Even worse, the base level specs are anemic for an $800 computer. While the former entry-level Mac mini included an Intel Core i5 processor and 500GB of storage, those are reduced to a Core i3 and just 128GB of storage for the new one. It's a bit of an imperfect comparison, since the new SSD and new CPU architecture are far better than the old ones, but it's still disappointing.

Nearly any way you slice it, spending $800 for a Core i3-powered desktop PC is a raw deal. Unfortunately, there's little competition in the mini desktop PC market now that many consumers are forgoing desktops in favor of

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laptops and 2-in-1s. One Mac mini competitor, the HP Z2 Mini G4, also includes a Core i3 in its base configuration but has an even higher starting price of around $900.

If you delve deeper into the Mac mini's new pricing, it eventually becomes apparent that Apple is shepherding customers who are seeking the best processing power or the most storage for their dollars into two separate configurations that each cost $1,099, or $300 more than the entry-level price.

People who need extra processing muscle for apps like Adobe Photoshop will gravitate toward a model with a 3.6GHz hexa-core Core i7 processor, with all other specs remaining the same. Meanwhile, those with large multimedia collections that require a roomier hard drive can instead opt for a 256GB SSD and a 3GHz hexa-core Core i5.

Both of these upgraded configs come with the base level 8GB of memory and Intel's integrated graphics processor. Both also include Intel's 8th-generation processor, which is light years faster than the fourth-generation chips in the previous Mac mini.

Still, none of this helps assuage the fact that the world is now a far bleaker place for Apple-loving cheapskates: You can no longer buy a brand-new Apple computer for less than $500, which is the upper bound that PCMag uses to define the cheap desktop category.

This means that cost-conscious consumers now have two options. They can begrudgingly lighten

their wallets by an additional $300, or an additional $600 for one of the more desirable $1,099 Mac mini configurations. Or, they can turn the other way, to very cheap, tiny Windows desktops such as the Intel Compute Stick or the legions of small PCs from brands they've probably never heard of, such as ECS, Shuttle, and Zotac.

Besides reasonable prices—you can pick up a Google Chromecast–size Intel Compute stick for as little as $99—tiny Windows PCs offer other advantages over the Mac mini. The larger ones of the bunch are often upgradeable, so you can add memory or storage as your budget and computing needs evolve. The Mac mini is not. Meanwhile, the smaller ones are so small that they can plug into the back of your TV, making them a better choice to power a wall-mounted TV.

None of these options offer Apple's macOS, of course, so if that's your operating system of choice, you've got to rule them out or consider switching to Windows.

But while the Mac mini may now be a poor value in terms of its core components, Apple made useful, thoughtful improvements to the ancillary features of its smallest PC. For example, its port selection now includes a whopping four USB-C ports, all of which support Thunderbolt 3. You'd be hard pressed to find another desktop this size that includes more than two Thunderbolt 3 connectors.

Even better, the Thunderbolt 3 ports don't come at the expense of regular USB Type-A ports, bucking Apple's trend of ditching these older but still very useful ports on the MacBook Pro,

“Apple made useful, thoughtful improvements to the ancillary features of its smallest PC.”

MacBook Air, and MacBook. This is great news for people who want to use external hard drives instead of face the astronomical costs of adding a larger internal SSD—a 1TB SSD will cost you a cool $800 premium.

In addition to an improved I/O complement, the new Mac mini also now comes in the space-gray color of the rest of the Mac lineup, which means it will nicely match the space-gray keyboard and mouse Apple introduced with the iMac Pro.

As welcome as they are, none of these benefits excuses the fact that Apple just killed off its only inexpensive Mac. For the most damning proof of Apple's decision to abandon the low end of the PC market to focus on well-heeled shoppers, consider that while the company won't take your $499 anymore, they'll gladly sell you a Mac mini loaded with every available hardware option at a conniption-inducing $4,200.

None of these benefits excuses the fact that Apple just killed off its only inexpensive Mac.

Apple iPad Pro (12.9-Inch, 2018): Not Quite Pro Enough

Apple iPad Pro
(12.9-Inch, 2018)
$999.00

Apple's 2018 iPad Pro is stuck in the middle again, now more than ever. The tablet has powerful hardware begging for software that hasn't been written for it yet. It's very pretty and very fast, but starting at $999 for the 12.9-inch model we tested, it's too expensive for the operating system and applications it runs. iOS was designed for simple single-tasking, single-application workflows. Its multi-window solution and Files app are kludgy bolt-ons. There's no great video-editing software. Photoshop is coming, but not until 2019. There's less peripheral support than there should be. Ultimately, it just doesn't add up to a pro experience.

PRICING

The iPad Pro is massively expensive for a tablet. The 11-inch model starts at $799 and the 12.9-inch model starts at $999. That's for a 64GB, Wi-Fi unit, though. There are also 256GB, 512GB, and 1TB units. Adding an LTE modem is an extra $150. A 12.9-inch, 1TB unit with cellular costs $1,899, without a keyboard or stylus. The Smart Keyboard Folio costs $199 for the 12.9-inch model, or $179 for the 11-inch one. The Apple Pencil costs $129.

In other words, it is now possible to pay more than $2,000 for an iPad.

Of course, if you simply want an iPad, you could opt for the $329 base-model 6th-gen iPad. You have to stop thinking of the Pro as an iPad, though. To justify its price, it has to do a lot more.

DESIGN AND ACCESSORIES

As mentioned, the iPad Pro comes in two models, 11 inches or 12.9 inches. We tested the 12.9-inch, 1TB unit. They are both smaller and lighter than last year's iPad Pros, because they have much smaller bezels. The "liquid retina" LCDs are excellent as usual, with 120Hz refresh rates and wide DCI-P3 color gamuts. To keep app compatibility, Apple has locked all of its iPad displays at 264 pixels per inch, which means that as the screens get larger, they get more pixels.

Apple iPad Pro
(12.9-Inch, 2018)

PROS Amazingly fast hardware. Excellent networking capabilities. Good cameras. New Apple Pencil is terrific.

CONS Hardware is held back by its operating system.

I can't conceive of this tablet being used without Apple's Smart Keyboard Folio, a magnetic keyboard case/cover. It has two positions to put your screen in: a more upright one that tends to be a little too reflective, and a more angled one that gives you a better view. The fabric-covered keys actually feel better to type on than those of a second-generation MacBook Pro; they have a definitive click, but it's a soft one that doesn't hurt your fingers if you're a hard typist.

“The fabric-covered keys actually feel better to type on than those of a second-generation MacBook Pro.”

The Pro tablets have rounded corners but harder edges than the standard iPad. They also have a flat back with a noticeable bump for the 12-megapixel camera. On the front, there's no home button anymore—as with the new iPhones, you'll be using Face ID with the 3D front-facing camera. The tablets have a single USB-C port at the bottom and loud quad speakers placed on the sides (when in landscape mode). The top-right edge of the tablet (depending on whether you're in portrait or landscape) is magnetic, and the new Apple Pencil clips right on.

The new Pencil is one of the strongest reasons to buy a new iPad. Current Pencil users are probably irritated by two major structural flaws: The cap is easy to lose, and its perfectly cylindrical shape will roll off anything. There's also nowhere to store it.

The new Pencil has a matte finish and a flat side. If you put it on the table and push, it will come to a stop. The back end isn't removable, and the Pencil securely, magnetically docks to the top of the iPad, where it also charges. This is such a big improvement. It means you always know where your Pencil is, and it's always charged.

The Pencil has new functionality, too. Double-tapping on the barrel switches modes, for instance between pencil and eraser; it's controllable by individual apps. This is similar to Wacom styli with buttons, so it really brings the Pencil to a place professional stylus owners are used to.

The Pencil is as sensitive as ever, with amazing pressure and tilt sensitivity. Call up, say, a watercolor brush in an app like Procreate, and the Pencil's pressure and tilt sensitivity will feel practically like a brush. The new Pencil only works with new iPads, so if you make your money based on artistic endeavors, that's a strong argument for getting the new models.

RAW POWER

Apple's A12X processor benchmark-tests as well as a pro laptop. What this thing can do is stunning. I compared it with three of this year's Macs using Geekbench, a CPU benchmark test I've always thought is a little biased toward iOS; GFXBench, a relatively neutral graphics benchmark that uses Apple's Metal APIs; and Basemark Web, which tests rendering performance in Safari. Take a look at the results.

Product	Processsor	Graphics	SSD
Apple MacBook Air (2018)	Intel Core i5-8210Y (1.6GHz)	Intel UHD Graphics 617	8GB RAM; 256GB SSD
Apple Mac Mini (2018)	Intel Core i3-8100B (3.6GHz)	Intel UHD Graphics 630	8GB RAM; 128GB SSD
Apple MacBook Pro 13-inch (2018)	Intel Core i7-8559U (2.7GHz)	Intel Iris Plus 655	16GB RAM; 2TB SSD
Apple iPad Pro 12.9-inch (2018)	Apple A12X	Apple A12X	6GB RAM; 1TB SSD

That said, when we tried to go into other workflow comparisons, we couldn't. The pro applications that we like to use on other operating systems, most notably Photoshop and Handbrake, just don't run on iOS, and the workflow benchmarks we like to use, like PCMark and Cinebench, don't run on iOS either.

On the raw benchmarks, the iPad Pro comes out faster than a Mac mini and often faster than an Intel Core i7 MacBook Pro. From a hardware perspective, this 2-in-1 is worth every dollar Apple is charging for it. The speeds we saw in our benchmark testing carried through in our day-to-day experience, with everything moving along effortlessly.

On the raw benchmarks, the iPad Pro is faster than a Mac mini and often faster than an Intel Core i7 MacBook Pro.

NETWORKING AND BATTERY

The iPad's networking abilities are as fine as its processor performance. Like the iPhone XS Max, the cellular iPad Pro is based on the Intel XMM7560 modem, which can handle up to gigabit speeds. It has a physical SIM card slot and an embedded, software-configurable eSIM. They don't both work at once, but you can switch between them. The physical slot supports all the US and Canadian carriers; the eSIM supports AT&T, Sprint, and T-Mobile, and you can pick a service plan right from the Settings app.

LTE-wise, the Pro supports a wide range of US and international bands, including all the bands that each of the major US carriers use. It has Sprint and Verizon's old CDMA system in it, but that system is useless for data anyway, so it doesn't matter. What matters is that it verifies on Sprint's and Verizon's LTE networks.

For Wi-Fi, it can do simultaneous 2.4/5GHz 802.11n/ac with 80MHz channels. It has Bluetooth 5.0. Connectivity is, simply put, excellent.

We still have to run battery tests, but we have no reason to disbelieve Apple's quote of 10 hours of use at about half screen brightness, similar to the previous iPad Pro generation. This is shorter than some laptops we've seen, but most people find it adequate, and you can fast-charge the iPad with the largest USB-C power brick you can get your hands on (like the ones from recent Macs). It ships with a new 18W charger, but you should get a 30W charger, like the one Apple sells for $49, instead.

CAMERA AND USB-C

The lack of a home button makes the iPad's cameras more relevant than ever. The 12-megapixel, f/1.8 camera is definitely better than the base-model iPad's 8-megapixel camera, and it seems quite similar to the iPhone X camera, which is great. Fast autofocus, LED flash, and 4K video recording are all supported.

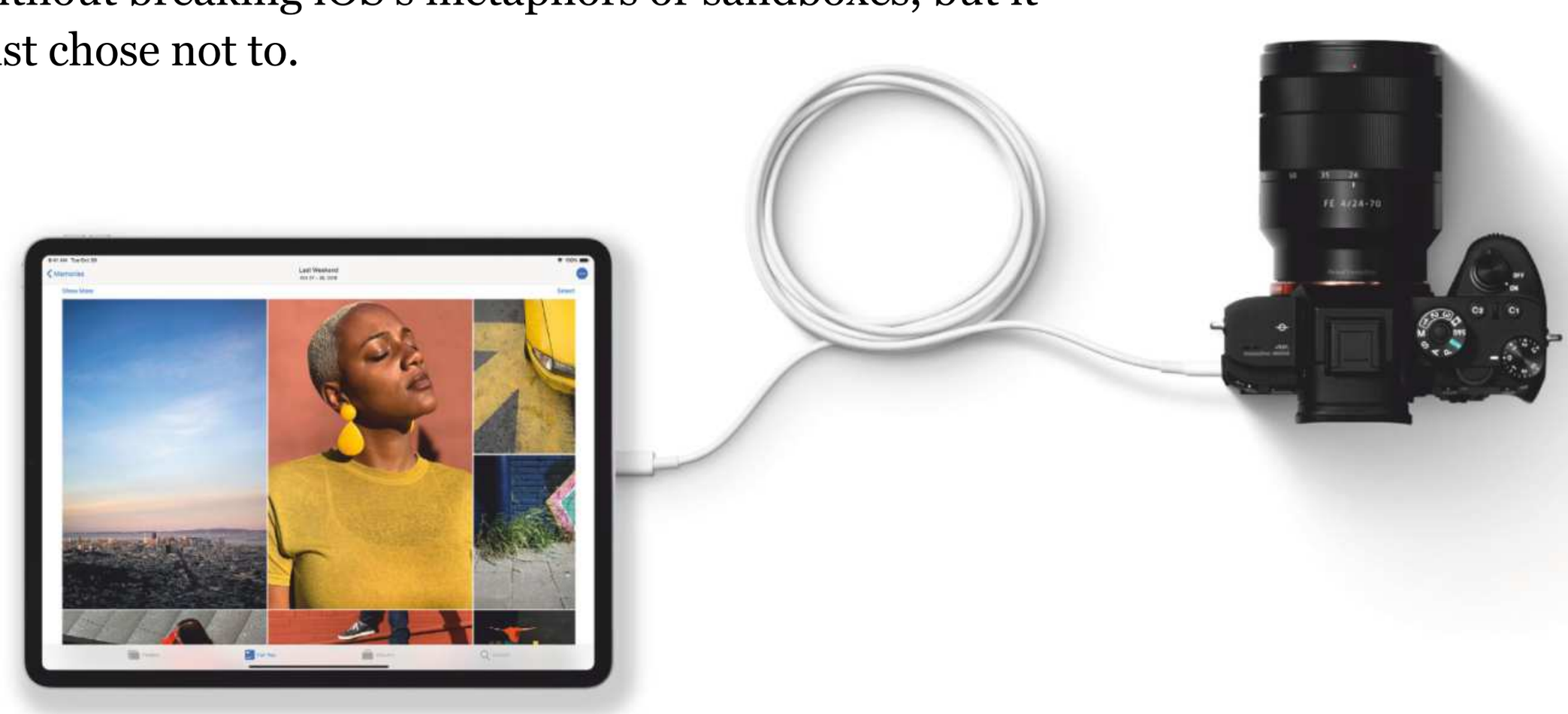
That said, I think the main camera's real use (and the real use for its better low-light performance) is in augmented reality applications, and the Pro places objects on horizontal and vertical surfaces very quickly.

The front-facing camera is a gigantic step up from the camera on the standard iPad, going from a 1.2-megapixel camera to a 7-megapixel sensor with 1080p video recording and 3D imaging that supports Face ID, Animoji, and Memoji. Face ID works in all orientations, and the front-facing camera is on par with the latest iPhones. With the powerful quad speakers, that makes this a terrific device for video chat.

> **Face ID works in all orientations, and the front-facing camera is on par with the latest iPhones.**

USB-C is a big step forward for the Pro but not as big as it could be. Once again, it's held back by iOS. You can plug in keyboards, and you can plug in docks that branch out into USB-A ports, DisplayPorts, and Ethernet ports. I've actually needed an Ethernet port for an iPad plenty of times, so the easy availability of USB-C-to-Ethernet adapters is nice. You can plug in USB-C headphones to get around the lack of a headphone jack.

I'm not too bothered about the fact that you can't plug in a mouse or trackpad on an OS that has no facility for a pointer. But you can't plug in arbitrary external storage or printers, and those are two big gaps. Ideally, you should be able to just plug in a drive and have it show up in the Files app, but that doesn't work: You need to use special drives that have iPad app support. Printing is wireless only. Apple could have created generic external storage drivers for the Files app without breaking iOS's metaphors or sandboxes, but it just chose not to.



Also, iOS's handling of multiple monitors is far from ideal. You can attach USB-C DisplayPort monitors via the USB-C port or translate to DisplayPort or HDMI (but not Thunderbolt) via a USB-C dock. But because iOS doesn't have a desktop, every application gets to figure out how to handle secondary monitors. Sometimes, they're for showing presentations while you look at notes on the main screen. Sometimes, they're for zooming in or out of artwork. They're never for being able to multitask more than you were able to otherwise.

NO PRO FLOW

The iPad Pro runs iOS 12. According to a poll we ran, about a third of people say they'll be able to use the iPad Pro as their primary computer. This is important because the price is just so darn high.

But in testing, I just kept running into the same old pro workflow issues that have bedeviled iPad owners for a while. For instance, my daughter is applying to a local arts high school. She wants to learn Toon Boom and Photoshop, standard apps in the animation industry. The Pro sounds perfect for that, right? There is no Toon Boom for iPad, however, and Photoshop is coming sometime in 2019.

I love to create data visualizations. Excel on the iPad Pro lets me insert charts and write directly on them, which is very cool. But I can't drag them into a Word document, even if the Word document is open in split-screen mode. I have to screenshot them, crop them, save them to the camera roll, and import that. Also, changing and moving around the axis titles is really buggy, unlike with Excel on every other operating system.

There are even some compatibility issues with iPad apps! Animatic, an animation program, crashes. Videoshop, a video-editing program, doesn't go into landscape mode. LumaFusion, the best pro video-editing app, has, let's say, an uncomfortable relationship with my OneDrive account.

The iPad Pro doesn't do a lot of existing work as well as the existing machines that do it. This is not down to the hardware; the processor, screen, and Pencil are top-notch. This is down to iOS's lack of mainstream pro applications and poor handling of peripherals and multi-application workflows. It's the same old story that we've been telling for years.

Apps like Procreate and other art titles can handle an essentially infinite number of layers with butter-smooth transforms.

The basic $329 iPad does a lot of the basic iPad tasks well. Want a great-looking, virus-free, well-supported computer for email, word processing, games, and cloud-based school work? Maybe a nice little SSH terminal? There's no need for an iPad Pro for any of those tasks. The A12X processor here is just overpowered for those workloads, and the other big Pro features you're paying for—the ProMotion screen, the new Pencil, the better speakers—don't add up to $500 of actually useful value.

So what does the Pro do well? Multilayer sketching is gorgeous. Apps like Procreate and a dozen other art titles can handle an essentially infinite number of layers with butter-smooth transforms. And the Pro does CAD and AR like no other device.

COMPARISONS AND CONCLUSIONS

The standard $329 iPad, which is really $600 to $800 once you add the keyboard, Pencil, and storage options you want, is a great little computer at the right price. For drawing, word processing, web browsing, a bit of photo editing, some content consumption, and gaming, an iPad turned into a 2-in-1 is efficient, no-nonsense, and virus-free. That's why it's an Editors' Choice and one of the products we most recommend.

The things you can't do with a base-level iPad aren't generally because of the hardware, they're because of the software—and the iPad Pro, unfortunately, still runs the same software. That puts the Pro miles behind more flexible Windows 2-in-1s such as the Microsoft Surface Pro 6 when it comes to running workflows such as Office apps, Photoshop, Lightroom, or, say, Toon Boom animation software. The Pro just can't step up. Its operating system and applications won't let it.

The Pro shines as a secondary tablet in costly creative setups. I'm talking about artists, animators, and photographers who don't mind spending up to five digits on their workspace and want the best. It beats a Wacom Cintiq, and it can be a useful tool for photographers on the go who want the best possible representation of their work.

Apple's engineering work is epic here. The iPad Pro is easily as powerful, and as well-engineered, as leading Windows 2-in-1s and Mac laptops. But until iOS gets proper hold of multi-application, multi-document, multi-tasking, and multi-device workflows, the Pro is a side dish, not a main course.

SASCHA SEGAN

“The iPad Pro is easily as powerful, and as well-engineered, as leading Windows 2-in-1s and Mac laptops.”

Amazon Kindle Paperwhite (2018): The Most for Your Money

PC MAGAZINE EDITORS' CHOICE

The first upgrade to Amazon's most popular e-reader in three years, the new Kindle Paperwhite is the least-expensive waterproof ebook reader on the market. It supports audiobooks and has a new flat-front design, making it ideal for beach reading. Reading or listening to a book on it is also simply calming, centering, and often joyous. For the price, this is the best Kindle yet, and our Editors' Choice.

Amazon Kindle Paperwhite (2018)

$129.99

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PRICE AND DESIGN

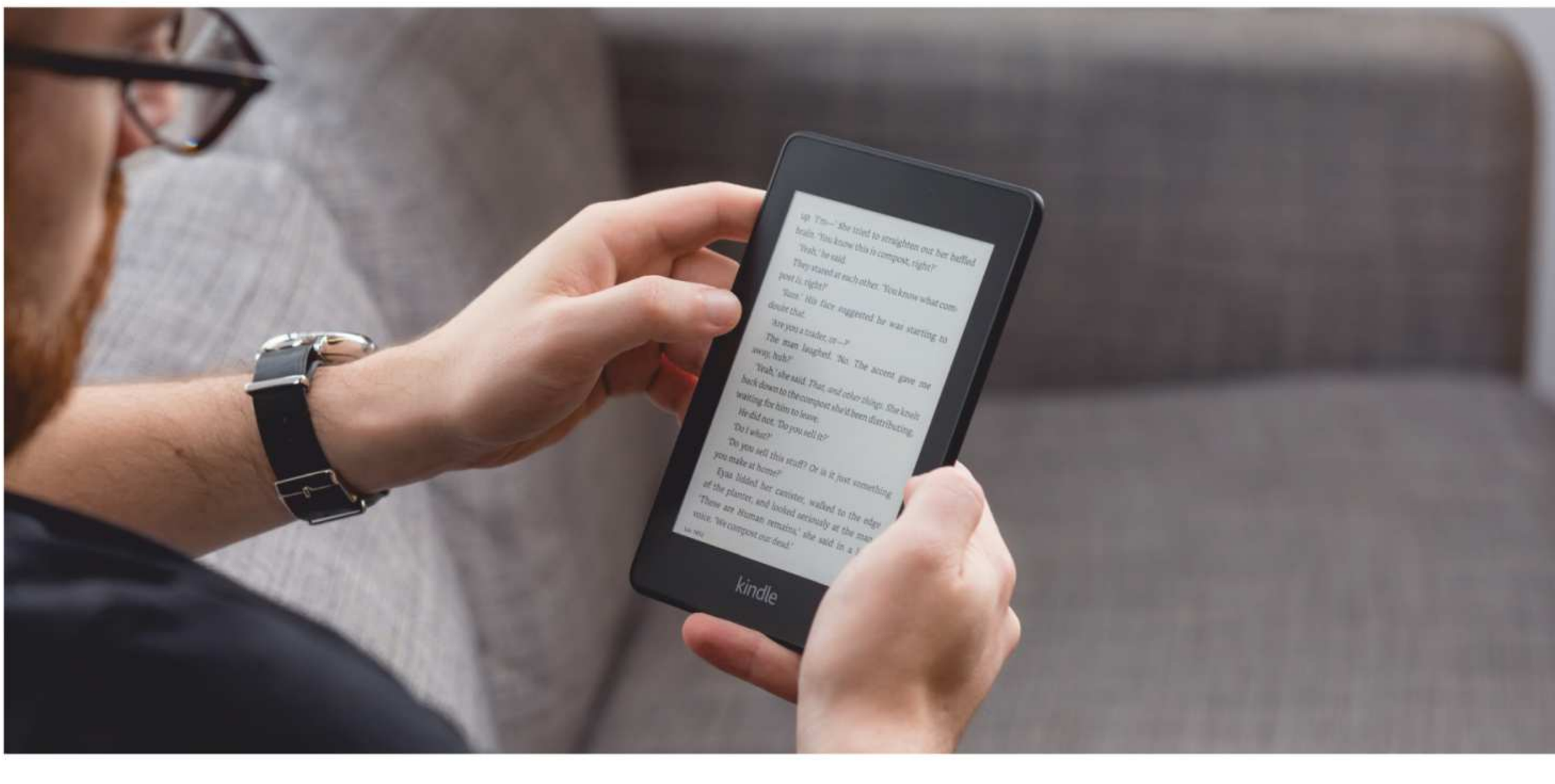
The new Paperwhite comes in three models: the default 8GB unit ($129.99), a 32GB version for people with a lot of audiobooks ($159.99), and a cellular-enabled unit for people who just can't wait to download their next read ($249.99). The other two models use 2.4GHz Wi-Fi to download books.

The device measures 6.6 by 4.6 by 0.3 inches (HWD) and weighs 6.4 ounces. It's noticeably lighter than the previous-gen Paperwhite (6.7 by 4.6 by 0.4 inches, 7.2 ounces), and it's just a little bit smaller all around, so it doesn't fit into older cases. Amazon plans to sell a range of cases, starting with a $29 water-resistant fabric cover in black, blue, or yellow and going up to $39 and $59 leather covers.

Amazon Kindle Paperwhite (2018)

PROS Waterproof. Flat front is easy to clean. Plays audiobooks over Bluetooth. Long battery life.

CONS Doesn't support Immersion Reading.



It has a matte-black back and a flat front with no visible buttons; it's entirely operated by touch. (If you want physical page turn buttons, upgrade to the $249 Kindle Oasis.) The power button and micro USB port are on the bottom, like always.

Battery life is the same as before and is highly dependent on your backlight usage. Pump it up to max, and you'll get 250 pages or so. Pull it down to half, and there's no problem with 500 to 600 pages. Turn it off entirely, and it can be weeks before you have to recharge.

The user interface is the same as on every Kindle—a mix of your books and Amazon's store interface. The new Paperwhite has a few nice new touches, though. Most notably, you can save packages of settings (font, size, spacing) and immediately jump to saved settings using a pop-down menu; that can help in families where different people with different font preferences are using the same Kindle.

KINDLE VS. KOBO

In the US, e-readers are pretty much a two-horse race. The two horses used to be Amazon and Barnes & Noble, but the Nook line took a dive on the track. Now it's American thoroughbred Amazon and the Canadian stallion, Kobo.

Amazon owns Audible, the big audiobook company, along with Goodreads. Amazon's audiobook experience is thus much better than Kobo's. The new Paperwhite plays Audible audiobooks through Bluetooth headphones (I tried two sets and had no issues). If a book supports it, you can also flip back and forth between the textbook and the audiobook, keeping them synced, even if you were listening to the audiobook on another device. Not all books support this (most notably, it didn't work with the new *Beastie Boys Book*), but it's very convenient when it works (as it did with Mur Lafferty's *Six Wakes*.)

The Paperwhite doesn't support Immersion Reading, Amazon's read-along function where narration plays while it skips across words on the page. That's a pity, but only a tiny one.

As for the Goodreads integration, things you read on a Kindle can be auto-logged in your Goodreads profile, and you can see on the device what the people you follow are reading. I don't care for this, because I use e-readers to get away from social media. But it's a well-done interface for those who like to be cheered on with their reading.

Kobo owns OverDrive, the company that lets you borrow ebooks from your local public library. Kobo's public library experience is, therefore, a little better than Amazon's. To borrow a library book with a Kindle, you go to the OverDrive website on your PC and select the book using a pop-down menu; the site will then wirelessly send the book to you. Your library can just appear as the native store on a Kobo.

The Kindle's main downside is how it's locked into Amazon's store. Amazon's store has everything you'll want to read; it's just the principle of the thing. You'll be able to read books purchased from Amazon, books from Amazon's Kindle Unlimited or Prime Reading subscription libraries, or books from your local public library borrowed via OverDrive. That's a lot of books! But there isn't much of a competitive marketplace for Kindle books. You can reformat other books into Kindle format using Amazon's free email-to-Kindle service or the free Calibre software, but in my experience, they sometimes have weird formatting and spacing errors when you do. Kobo supports more formats, for those who get books from places that use formats such as ePub and PDF.

Other minor quibbles: The backlight, while adjustable, doesn't change color, as does the cozy blue-to-yellow backlight on Kobo readers. And you should be reading books that are text, not pictures, as a 6-inch screen is just too small for comics or manga. (For manga, we suggest the $279 Kobo Forma; for Western comics, the $329 color Apple iPad.)

READING EXPERIENCE

This Kindle Paperwhite offers a nearly ideal reading experience—certainly the best you'll get at this price. Amazon added bells and whistles, of course. It offers a lot of fonts. You can use the X-Ray feature to double-check on the backgrounds of characters mentioned on a page, you can make highlights, and you can consult a dictionary.

I enjoy the adjustable backlight, which lets me read in total darkness. I like the easy ability to check the table of contents, make a bookmark, or pop back to a previous page because I forgot what happened to a character.

And reading on the Paperwhite is just plain enjoyable. When I use it, I don't open tabs. I don't respond to notifications or get caught in internet rabbitholes, like I'm doing in another window right now as I write this. I don't stress out very often about having a low battery, although I do stress out a little about whether I can afford the next book I want to buy. (Hooray for OverDrive.)

I just read. That's what a Kindle is for. And the $130 Paperwhite brings a fantastic reading experience with just about any feature you can hope for at a price that most people can afford.

“This Kindle Paperwhite offers a nearly ideal reading experience, certainly the best you'll get at this price.”

WHICH KINDLE IS RIGHT FOR YOU?

Kindles have very long replacement cycles, but it's worth looking at a new one now if you don't have a Paperwhite or have a very old one. The text on the 300ppi screen is sharper and cleaner than the text on lower-resolution models. You can still buy the base $79.99 Kindle, but this one is much easier on the eyes.

If you do have a more recent Paperwhite, the newest model's flat front is something to consider. Older Paperwhites have a recessed screen with a raised bezel around it. That's fine until you go to the beach. Unless you keep your Kindle in a plastic bag (which a lot of people do), it's easy to get grains of sand caught in the corners of that bezel. With the flat-front Kindle, sand just rolls off.

So does water, the biggest advance here. Kobo has had a $179.99 waterproof e-reader for a while (the Aura H2O), but up until now, if you wanted a waterproof Kindle, you had to go for the Kindle Oasis. The Oasis is great, but it's $250. You can nearly buy a Paperwhite for you and a friend at that price.

For $130, the Kindle Paperwhite offers more for your money than any other ebook reader on the market. It's a great option for just about everyone, and it's our Editors' Choice.

For $130, the Kindle Paperwhite offers more for your money than any other ebook reader on the market.

SASCHA SEGAN

Apple MacBook Air (2018): Retina Display and Updated Components

Apple MacBook Air (2018)

Starts at $1,199.00

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Apple's iPhones get significant feature overhauls nearly every year, but until November, one of Cupertino's most popular and affordable laptops had hardly changed at all since it was introduced in 2008. It's received minor spec bumps, but the MacBook Air has maintained the same overall physical appearance of the first-generation model, even while the MacBook and MacBook Pro got radical design overhauls. That changes with the new MacBook Air (starts at $1,199; $1,399 as tested), which has slimmed down, ditched its outdated display and CPU, and received several other overdue upgrades. These upgrades, unfortunately, do not result in excellent computing performance, but they do return the MacBook Air to its place among the best ultraportable laptops.

CATCHING UP WITH HISTORY

The new 13-inch MacBook Air comes more than 10 years after the original, whose unique wedge shape gave it a minimum height of just 0.16 inches and a maximum height of 0.76 inches. Those dimensions made Apple confident enough to promote it as the world's thinnest notebook. Then-CEO Steve Jobs famously unveiled the diminutive machine by pulling it out of a manila envelope, and the laptop-buying public went wild—at least until they realized that significant compromises were made to get the MacBook Air that thin, including ditching the optical drive and making the battery non-replaceable.

A decade has passed, and those compromises no longer seem so important now that CDs and DVDs are on their deathbeds, and most of the MacBook Air's competitors have non-replaceable parts as well. This period of innovation in the ultraportable laptop market, which in no small part owes its existence to the MacBook Air, saw the 13-inch Air itself remain largely the same. Sure, it slimmed down a bit, to a minimum of 0.11 inches and a maximum of 0.68 inches, and its screen gained a few pixels, but this and other minor improvements pale in comparison with the high-resolution displays and featherlight weight of some of its competitors.

Apple MacBook Air (2018)

PROS Retina display offers vivid colors. Very comfortable Force Touch trackpad. Secure boot capability. Two Thunderbolt 3 ports. Excellent battery life.

CONS No CPU configuration options. Y-series, not U-series, CPU. No touch screen. No USB Type-A ports or dedicated video output. Shallow key travel. Expensive as configured. Occasional fan noise.

Even Apple's other laptops eclipsed the MacBook Air in terms of raw innovation, with the MacBook Pro and MacBook adding Retina displays, slimmer chassis, power-efficient Intel processors, and even Touch Bars and fingerprint readers.

That Apple withheld these and other features from the MacBook Air isn't surprising from a marketing standpoint, since it needed an entry-level model to give context to its more premium notebooks. But with last year's minimally refreshed MacBook Air, the withholding started to become punitive. Apple updated the aging Intel processor with another one that itself was several generations behind the chip giant's latest and greatest silicon, a puzzling move that made Apple watchers wonder whether the MacBook Air was on life support.

That Apple withheld these and other features from the MacBook Air isn't surprising from a marketing standpoint.

ROARING BACK TO LIFE

The wondering ended this fall, when the MacBook Air roared back to life with nearly every major innovation that it has missed. Apple rejiggered the height a bit—the range is now between 0.16 and 0.61 inches, still with a sloping wedge—but the most striking visual change by far is that the laptop is now noticeably smaller than its predecessor both in width (11.97 inches versus 12.8 inches), depth (8.36 inches versus 8.94 inches), and weight (2.75 pounds versus 2.96 pounds).

These changes are most obvious when you open the new MacBook Air's lid. The edges of the keyboard and the display are now much closer to the edges of the chassis. Slim bezels are all the rage in consumer electronics today, and Apple has embraced them with both the iPhone and its other laptops, so adding them to the MacBook Air is the most important visual design change the company could have made to make the laptop appear more modern.

Other than slimmer bezels, the rest of the broad design strokes are largely the same. The percentage of recycled aluminum increased, and with the addition of Space Gray and Rose Gold, so did color choices. And of course, the Air still has no optical drive or user-accessible screws to let owners replace the battery or other components.

Gaze at the MacBook Air a bit longer, though, and you'll identify several major and arguably controversial physical changes. Apple has completely overhauled the input/output port selection, adding two USB-C ports that both support the lightning-quick, cutting-edge Thunderbolt 3 data transfer interface while ditching the more traditional USB Type-A ports and the mini DisplayPort video output. The only constant here is a 3.5mm headphone jack.

The port reconfiguration is decidedly modern, and it matches the USB-C-only complement of the MacBook and the MacBook Pro. But many Windows competitors manage to fit both USB Type-A ports and USB-C ports, recognizing that the complete switchover to USB-C is still several years away. With the MacBook Air, everything from the power cable to your external monitor and mouse get plugged into the USB-C ports, so you'll almost certainly need to buy at least one adapter.

The second controversial physical change is the addition of a keyboard with Apple's unique butterfly-style switches. When struck, each key travels a far shorter distance than every other laptop key I've ever used. It's a jarring feeling at first, though I've gradually become accustomed to tapping instead of striking the keys. I far prefer the keyboards on Lenovo's ThinkPad lineup, and I'm keenly aware of the significant redesigns Apple made to address flaws on previous generations of the butterfly switch design, which resulted in a lawsuit. Even so, I appreciate the keys for their stability and the satisfying thud they make when they're depressed.

FORCE TOUCH

A far less controversial hardware change is the addition of a Force Touch trackpad to the MacBook Air. The old trackpad surely held its own compared with the often-clumsy pads on Windows competitors but paled in comparison to the giant, wondrous, hingeless Force Touch pad on the MacBook Pro. It's the best, most precise touch pad I've ever used. Not only are your finger motions registered with extreme accuracy, but clicks are completely virtual—they're simulated by tiny vibrations called haptic feedback instead of a physical hinge. The result is the unique-to-Apple ability to click anywhere on the oversized pad and receive a uniform level of feedback, eliminating a ton of unnecessary finger movements.

You can even customize how strong the virtual clicks are, turn them off completely, and adjust other features such as multitouch gestures in Apple's System Preferences app. Through its Precision Touchpad initiative, Microsoft has been pleading with Windows laptop makers to improve their pads for years, but none has come close to Apple's Force Touch marvel.

Not only are your finger motions registered with extreme accuracy, but clicks are completely virtual.

Another unequivocal hardware improvement is the MacBook Air's Retina display. The previous generation has a woefully low-resolution 1,440-by-900-pixel screen in an era when it's very difficult to find another laptop for sale for more than $1,000 with anything less than a full HD resolution (1,920 by 1,080). The new panel is a gorgeous Retina display, with a resolution of 2,560 by 1,600 and In-Plane Switching (IPS) tech to prevent washout when you're looking at it from extreme angles.

As nice as the new Retina display is, however, Apple could have done even better. It didn't include True Tone calibration to adjust the white balance to the ambient color temperature in the room, a feature reserved for some MacBook Pro models. In casual testing in PC Labs, I also found the new MacBook Air's display slightly dimmer than the 15-inch MacBook Pro at full brightness. And there's no touch-screen option—you can't add the thin Touch Bar as an optional extra like you can with the 13-inch MacBook Pro.

The new MacBook Air does come standard with Apple's fingerprint reader and T2 coprocessor, though. The reader is nifty enough, doubling as the power button and recognizing my print with 100 percent accuracy over several days. The T2 chip is far more innovative, providing security features more common to business machines than to consumer ultraportables.

The T2 consolidates many behind-the-scenes tasks previously accomplished by multiple pieces of silicon—the system management controller, image signal processor, audio controller, and SSD controller—into a single chip. But its most noticeable benefit is security. It handles encrypting the hard drive, checking for evidence of hacker tampering at startup, and authenticating purchases you make online with Apple Pay using your fingerprint. The T2's secure boot technology uses the same code found in the security features of iOS, which famously thwarted even the FBI's efforts to hack it.

Many of these features are available in Windows machines equipped with Intel's enterprise-focused vPro security tech. Unfortunately, vPro isn't available on most consumer laptops. That Apple's own capable coprocessor now graces its latest entry-level notebook is noteworthy and possibly a harbinger of future Intel-free Mac computers.

The new MacBook Air comes standard with Apple's fingerprint reader. It doubles as the power button and recognized my print with 100 percent accuracy over several days of locking and unlocking the laptop.

NICE, NOT NOTEWORTHY

Other MacBook Air features are nice to have but hardly noteworthy. The 720p webcam centered above the display provided adequate but slightly grainy image quality for a quick Photo Booth session in my testing. It lacks the physical security door that some Windows laptops now come with to thwart a hacker's attempt to spy on you, but the T2 chip severs the built-in microphone's connection to the operating system when you close the lid, providing at least some reassurance against surveillance.

Sound quality is decent. Apple says the new MacBook Air's speakers are 25 percent louder and deliver half again as much bass as the old one. I listened to a few seconds of the same movie on both machines, one right after the other, and while I didn't notice any more volume, I did find that the sound was significantly richer.

Wireless connections—ever important since the physical port selection necessitates an adapter to connect to many peripherals—include 802.11ac Wi-Fi and Bluetooth 4.2. The MacBook Air struggled to stay connected to a 5GHz signal during my testing at home when all of my other devices had no issues. It had no trouble with the 2.4GHz signal from the same network, however.

In addition to the included one-year warranty, you can also purchase three years of additional coverage for the MacBook Air from Apple.

HO-HUM PERFORMANCE PER DOLLAR

The new base-model MacBook Air comes with a 1.6GHz low-power Y-series Intel Core i5 processor, 8GB of memory, and a 128GB PCI Express SSD for system storage. If you've already started your laptop shopping, you'll have noticed that many laptops in the MacBook Air's price range come with significantly better components. A full-powered U-Series Core i5 and 256GB of storage are more common. The $1,400 Asus ZenBook S even comes with a Core i7 and 512GB of storage.

You can upgrade the MacBook Air's storage and memory, of course. Configuration options include 16GB of RAM and a 256GB, 512GB, or 1.5TB SSD. As is common with Apple computers, however, adding options drains your wallet at an alarming rate. The model I tested comes with a 256GB hard drive—all but a necessity in a world of space-devouring 64-bit apps and large photo libraries—for an additional $200. Load up all the options and you arrive at a cool $2,600 asking price.

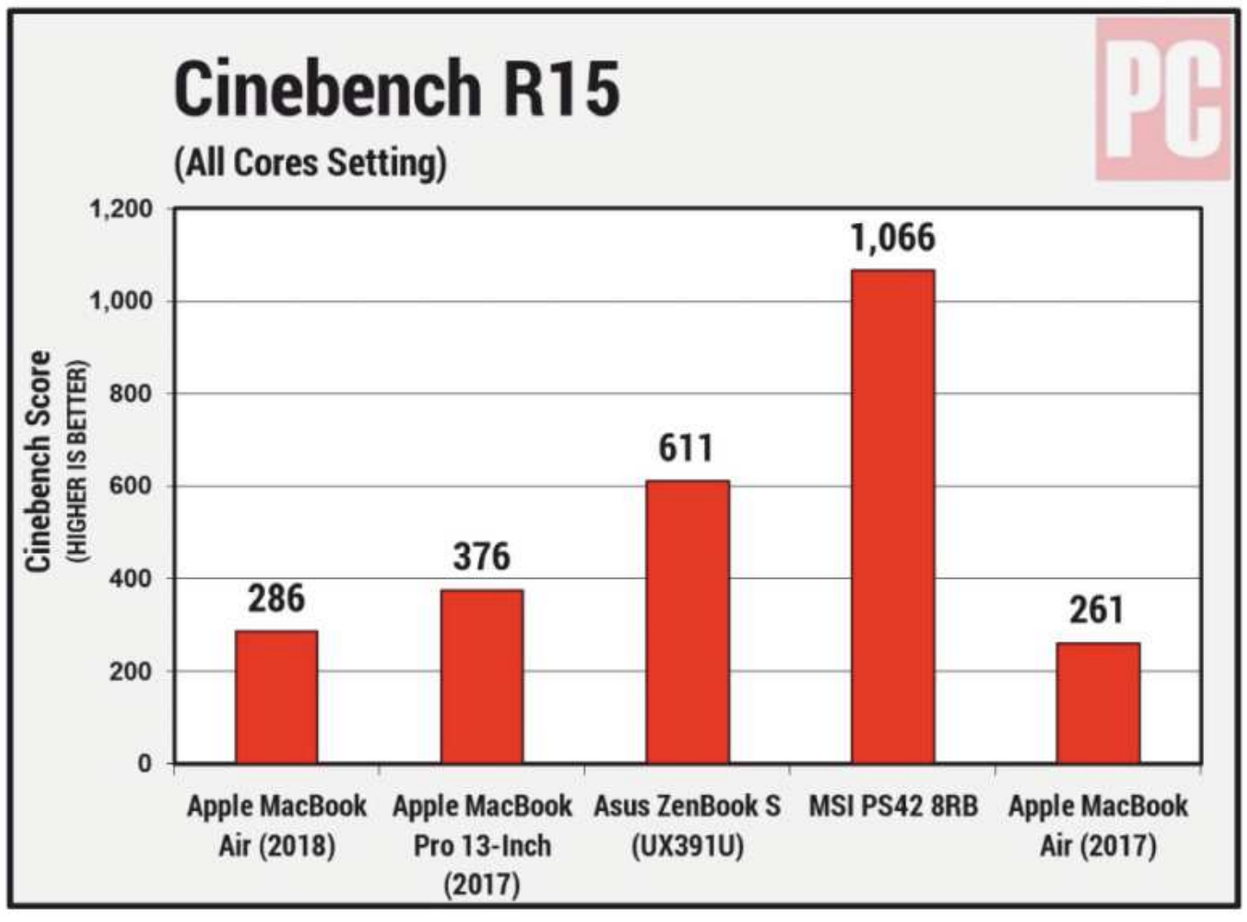
That's an unthinkable sum to spend on an ultraportable laptop with a Y-series Core i5 processor. Unlike with the MacBook Pro, Apple doesn't offer a Core i7 upgrade option for the new MacBook Air. Its predecessor, which is still available, does offer an optional Core i7, but it's several generations old, so I don't recommend buying it under any circumstances. The MacBook Air is therefore not a great value when it comes to raw computing performance, the kind you need to render a 3D image or manipulate 4K video footage.

So, first a quick look at our comparison set:

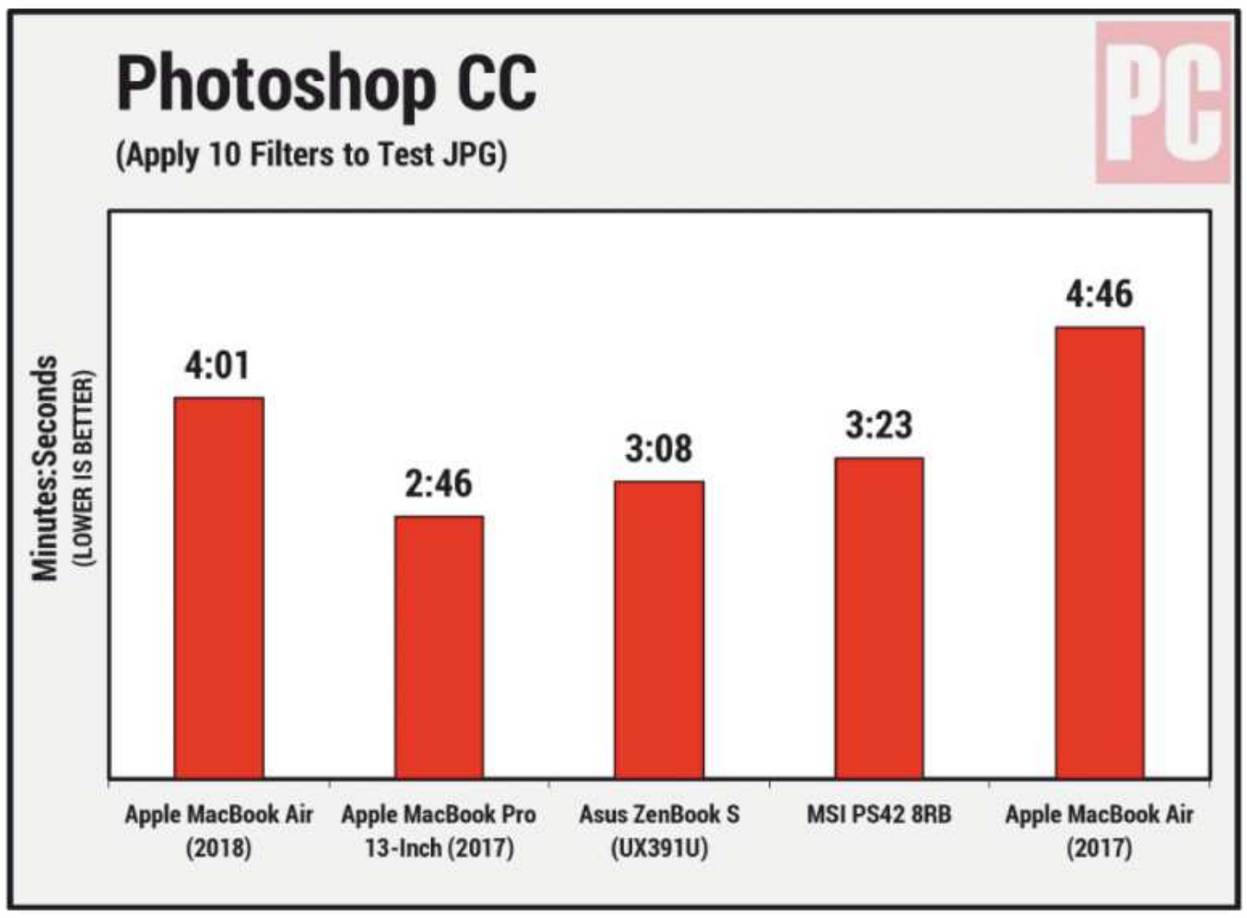
Test System Configurations

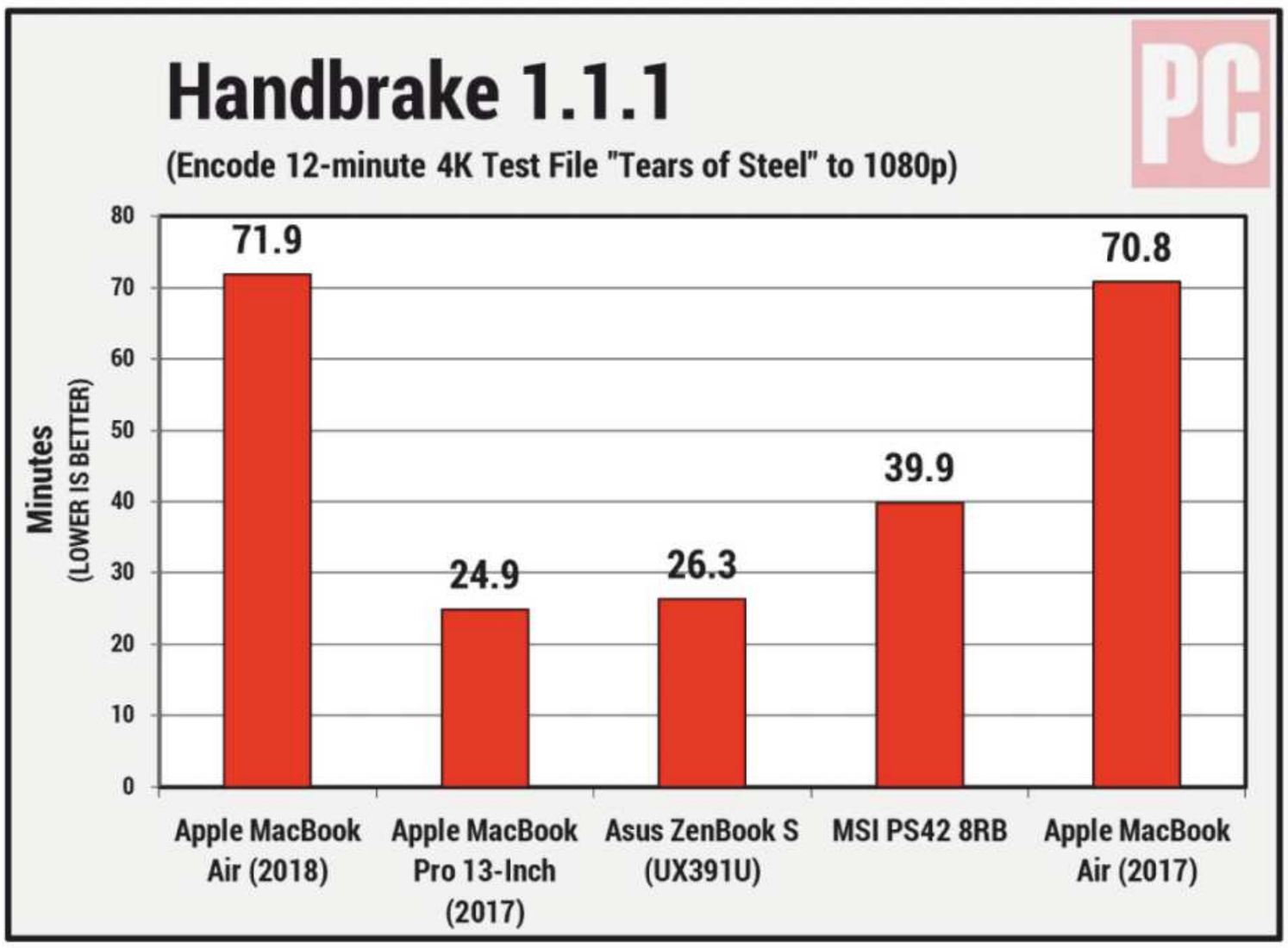
PRODUCT NAME	PROCESSOR	GRAPHICS	RAM & STORAGE
Apple MacBook Air (2018)	Intel Core i5-8210Y (1.6GHz)	Intel UHD Graphics 617	8GB RAM; 256GB SSD
Apple MacBook Pro 13-Inch (2017)	Intel Core i5-7360U (2.3GHz)	Intel Iris Plus Graphics 640	8GB RAM; 128GB SSD
Asus ZenBook S (UX391U)	Intel Core i7-8650U (1.9GHz)	Intel UHD Graphics 620	16GB RAM; 512GB SSD
MSI PS42 8RB	Intel Core i7-8550U (1.8GHz)	Nvidia GeForce MX150 (2GB)	16GB RAM; 512GB SSD
Apple MacBook Air (2017)	Intel Core i5-5350U (1.8GHz)	Intel HD Graphics 6000	4GB RAM; 128GB SSD

Perhaps nowhere is this lack of outright muscle more evident than in our Cinebench test, a 3D rendering exercise that taxes all of a CPU's available cores and threads. The MacBook Air achieved a score of 286 on this test, compared with 611 for the Asus ZenBook S, which boasts a much more powerful Intel Core i5-8250U with four cores and eight threads. The Core i5-8210Y, by contrast, has half the number of cores and threads.



The story is much the same when it comes to transcoding a 4K video file to a 1080p file using the Handbrake app. This task took the MacBook Air 1 hour and 11 minutes, compared with a little more than 26 minutes for the ZenBook S. Neither is the MacBook Air very good at editing images in Adobe Photoshop. It finished applying our series of 10 filters to a test image in 4 minutes and 1 second, compared with 3:26 for the ZenBook S and 2:46 for the MacBook Pro.





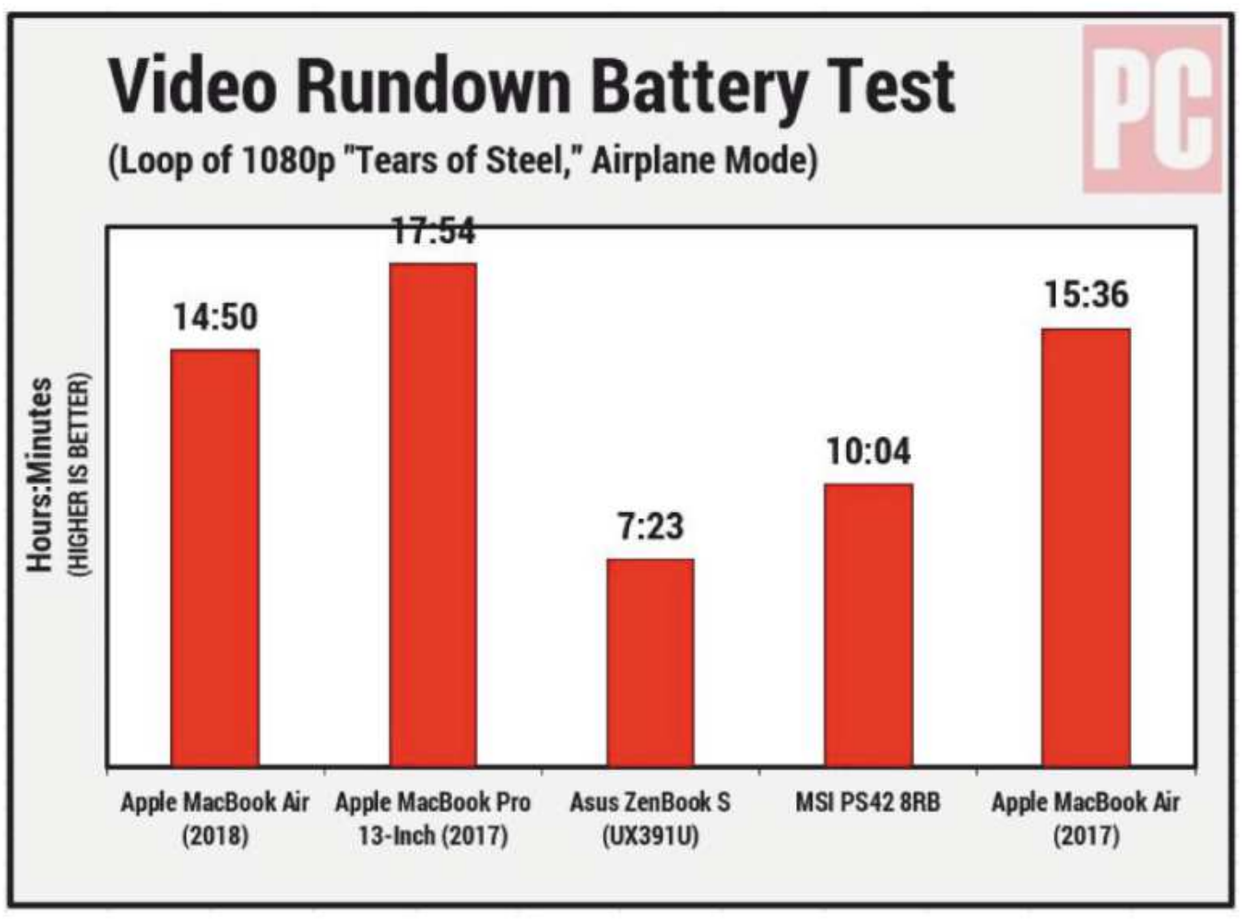
While the MacBook Air lags behind similarly priced competitors on these tests, it's important to remember that no ultraportable excels at these tasks at any price, constrained as they are by limited space to cool their CPUs and GPUs. The same is true of gaming: The MacBook Air displayed an average of 17 frames per second on our Heaven game simulation at medium quality settings and 1080p resolution. For a true multimedia powerhouse, you'll have to step up to a workstation-class Windows machine or the 15-inch MacBook Pro with its powerful graphics chip and available Core i9 CPU.

None of this really matters much if you're using the MacBook Air mostly for casual computing tasks such as web browsing and word processing. During a full weekend of use, I never experienced any lag or sluggishness, even with multiple tabs open in the Safari browser, including one streaming video. Everything felt very snappy. This is a far better experience than any Windows laptop with a Y-series processor I've used, all of which occasionally hung when multiple tabs or open or even while opening folders in Windows Explorer.

During a full weekend of use, I never experienced any lag or sluggishness, even with multiple tabs open.

Fan noise was noticeable while streaming video and running benchmarks, and the bottom of the MacBook Pro became rather warm to the touch. Apple has adjusted cooling firmware before, including to correct a high-profile incident with the 2018 MacBook Pro's cooling system, so it's possible that the MacBook Air's fan noise could be reduced with a future software update.

The Y-series Intel chips are designed to consume just 7 watts of power under normal conditions, compared with 15 watts for the U-series chips. This translates into excellent battery life. I never once had to plug in the MacBook Air during a weekend of use at several hours per day. Our battery rundown test, which involves playing a 1080p local video file at 50 percent screen brightness with Wi-Fi and Bluetooth off, confirms the laptop's stamina.



The result of more than 13 hours is excellent compared with the ZenBook S (7:23), though a bit below the even longer times we've seen from other Macs like the MacBook Pro (17:56).

A WELCOME IMPROVEMENT

The MacBook Air helped usher in the era of ultraportable laptops, and this year's update is a sign that Apple still believes in it. There's nothing revolutionary about the Retina display, the Thunderbolt ports, the Force Touch trackpad, or the slimmed-down chassis, but they're excellent improvements. And in the case of the trackpad, it's an improvement that you can only find on an Apple laptop.

As a result, the MacBook Air is better than its predecessor in every way, but it's not necessarily a no-brainer purchase for everyone. It's unquestionably a poor value in terms of computing performance per dollar, but that should matter only to people who occasionally need to edit multimedia. Alternatives like the ZenBook S or the 13-inch MacBook Pro are better suited to this and other similar resource-intensive tasks.

Ultimately, if you must have a macOS machine for casual use, the MacBook Air will not let you down. More capable than the 12-inch MacBook with its single I/O port and less expensive than the MacBook Pro, the Air offers a thoroughly excellent experience for performing casual computing tasks and a healthy (though not exhaustive) dose of the latest Apple innovations.

TOM BRANT

This laptop offers a thoroughly excellent experience for performing casual computing tasks.

Corsair Vengeance Gaming PC 5180: Packed With Power

PC MAGAZINE EDITORS' CHOICE

Corsair has long been known for its components and gaming peripherals, but it became a PC maker for the first time in 2017 with the One Pro. Now, it's back with a second effort in a somewhat more traditional form: The Corsair Vengeance Gaming PC 5180. This powerful gaming desktop comes equipped with an Nvidia GeForce RTX 2080, ready for whatever games you throw its way across the spectrum of resolutions. While not especially compact, its square case is nicely designed and ready for standard component swaps or upgrades, unlike the One Pro. With a reasonable price, considering what's packed inside, and performance to match, the Vengeance 5180 earns an Editors' Choice for midrange gaming desktops.

Corsair Vengeance Gaming PC
5180

$2,399.00

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EMBRACE THE CUBE

The Vengeance, while still relatively compact, is much larger than Corsair's first effort. The One Pro was a small, cylindrical desktop, while the Vengeance is built into Corsair's Crystal Series 280X, a midsize cube-like chassis. Despite the microATX build, it's not especially small at 13.8 by 10.9 by 15.7 inches (HWD). The Dell Inspiron Gaming Desktop, our Editors' Choice budget gaming desktop, is a traditionally shaped tower that stands at 18 by 8.5 by 17.23 inches. That's taller than the Vengeance but not as wide or deep, meaning it takes up less overall desk space.

The case is entirely black with a metal frame. It's split asymmetrically along the top and front face, with two-thirds made of glass while the rest is plastic. The left panel is the glass side, through which you can see the high-end components. The glass has the word "Vengeance" etched into it, and under that, in a smaller font, the words "the gaming PC from Corsair." This seems a bit unnecessary, particularly the latter portion, but I suppose it's a free promotional space.

Corsair Vengeance Gaming PC
5180

PROS Great gaming performance. Plenty of speedy SSD storage. Well-designed case with tempered glass and attractive customizable lighting. Spacious interior.

CONS Etched text on glass is a bit tacky. Bulkier form factor compared with some microATX PCs.

There’s also some hard-to-miss built-in case lighting. The two 140mm front fans and two 120mm top fans are ringed with customizable LEDs. The former are set right behind the glass, while the latter are attached to the underside of the included Corsair Hydro Series H100i Pro liquid cooler’s radiator. The cooling block over the CPU is also outfitted with some shiny RGB lighting and the Corsair logo.

Since the glass panel covers the components, it’s removable with four simple hand screws (if these are tightened too much, you may have to break out the screwdriver). The top panel is accessible in the same fashion, so you can get to the radiator screen filter. All said, the Vengeance is a well-designed desktop, even if it’s not exactly a space saver.

PREMIUM PARTS

Because of the relatively spacious build (despite the microATX board), there’s plenty of room to work inside the case, should you want to swap out parts or do some maintenance. You’d be hard-pressed to improve significantly on what comes installed, however. As you’d expect, it’s filled with plenty of Corsair components. The company, after all, has been in the PC-building business. The Vengeance 5180 includes a 3.19GHz Intel Core i7-8700 processor, an Nvidia GeForce RTX 2080 graphics card (MSI’s Ventus model), 16GB of memory via two 8GB sticks of Corsair Vengeance RGB Pro DDR4 RAM, a 480GB M.2 NVMe SSD, a 2TB hard drive, and a 750W power supply.

Given those parts, the Vengeance 5180's price doesn't seem so high. You could save a bit of cash by looking for deals on these components and using a cheaper case, but the build here is solid, and the unit comes with customer service and a two-year warranty.

If the price still seems high to you, note that Corsair also includes its K55 RGB gaming keyboard and its Harpoon RGB gaming mouse in the box. The keyboard ($49.99 on its own) is non-mechanical but features dedicated media keys, macro keys, and customizable lighting. The mouse ($29.99) is a little more basic, with a 6,000DPI sensor, a customizable logo light, and just a couple of programmable buttons. While it can be nice to have peripherals included, a lot of gamers already own them (or would rather pick their own) and wouldn't choose to have them added to the cost.

A Netgear Wi-Fi adapter also comes in the box, which is important because the Vengeance 5180 doesn't have built-in Wi-Fi. You will probably use a wired connection on your fancy gaming computer anyway, but if you do need to be wireless, you'll have to use this USB dongle. For this and other physical connections, the system includes plenty of ports. On the top panel, at the front of the case next to the power button, are two USB 3.1 Gen 1 ports, a mic jack, and a headset jack. Around back are four USB 2.0 ports, a USB 3.1 Gen 2 port, a USB-C port, an Ethernet jack, and the three DisplayPort connections and one HDMI port belonging to the RTX 2080.

On the top panel at the front of the case next to the power button are two USB 3.1 Gen 1 ports, a mic jack, and a headset jack.

Finally, there's the Corsair iCUE software for customization, which lets you alter the case lighting and fan behavior and monitor system performance. The dashboard tab provides an overview of various component temperatures and fan speeds in a clean layout. In the instant lighting tab, you can configure the color and effects of the LEDs on the RAM, cooling block, and case fans (via a controller node). The first two are straightforward, while the case fans take a bit more time with the settings to figure out. On the whole, though, the software is simple and effective.

SAILING THE HIGH SPEEDS

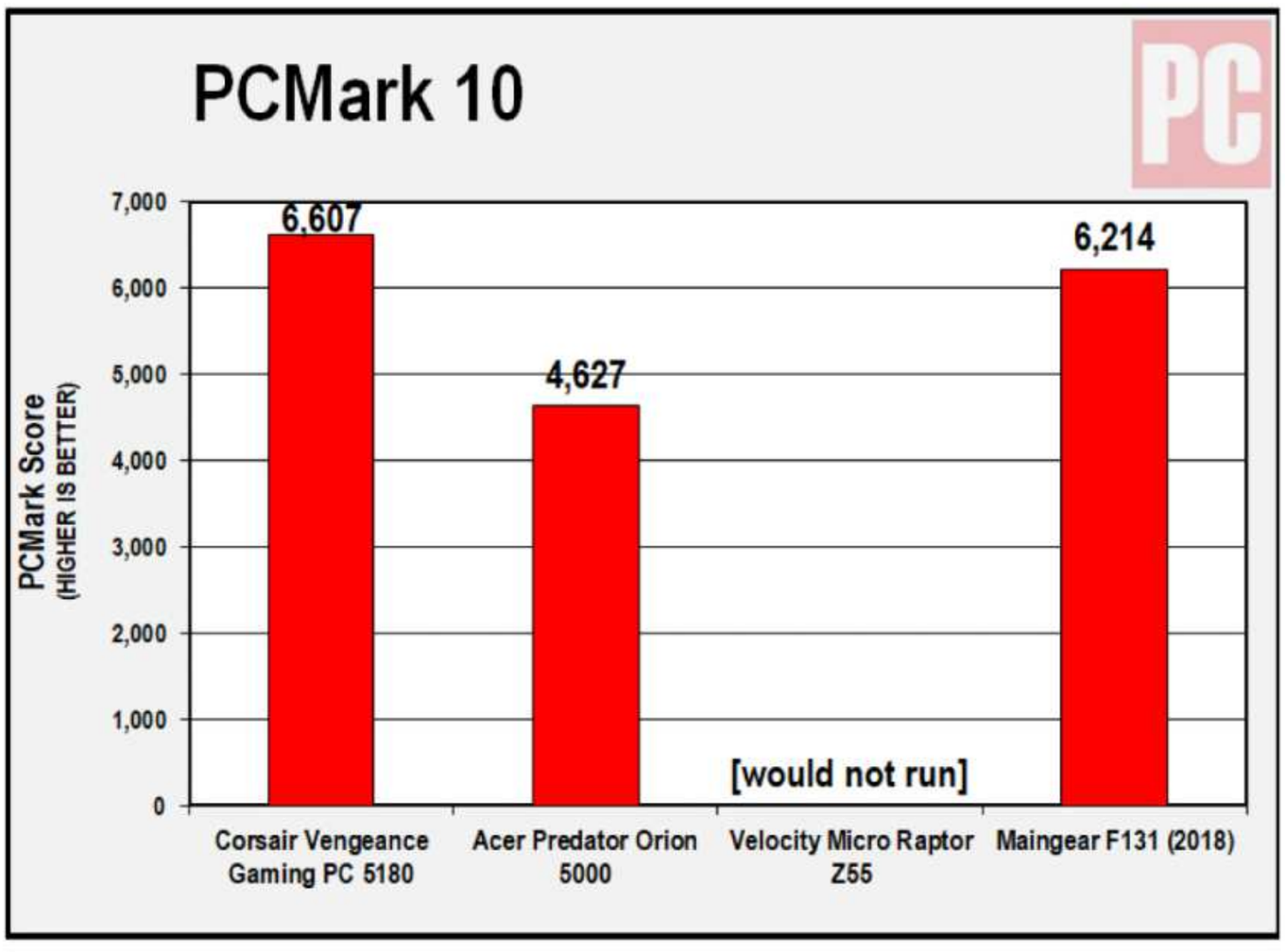
With its high-performance (though still not quite top-of-the-line) parts, I expected the Vengeance 5180 to be plenty fast, and it didn't disappoint. I should also note that it also wins the honor of being the first PC reviewed with our updated suite of benchmark tests. As such, these results should be a good measure of the modern workload put on a machine. A downside is that for the time being, we have a much smaller set of data to compare the new results against. To help alleviate that problem, we back-tested a handful of recent systems to get as many relevant points of comparison as we could.

Test System Configurations

PC

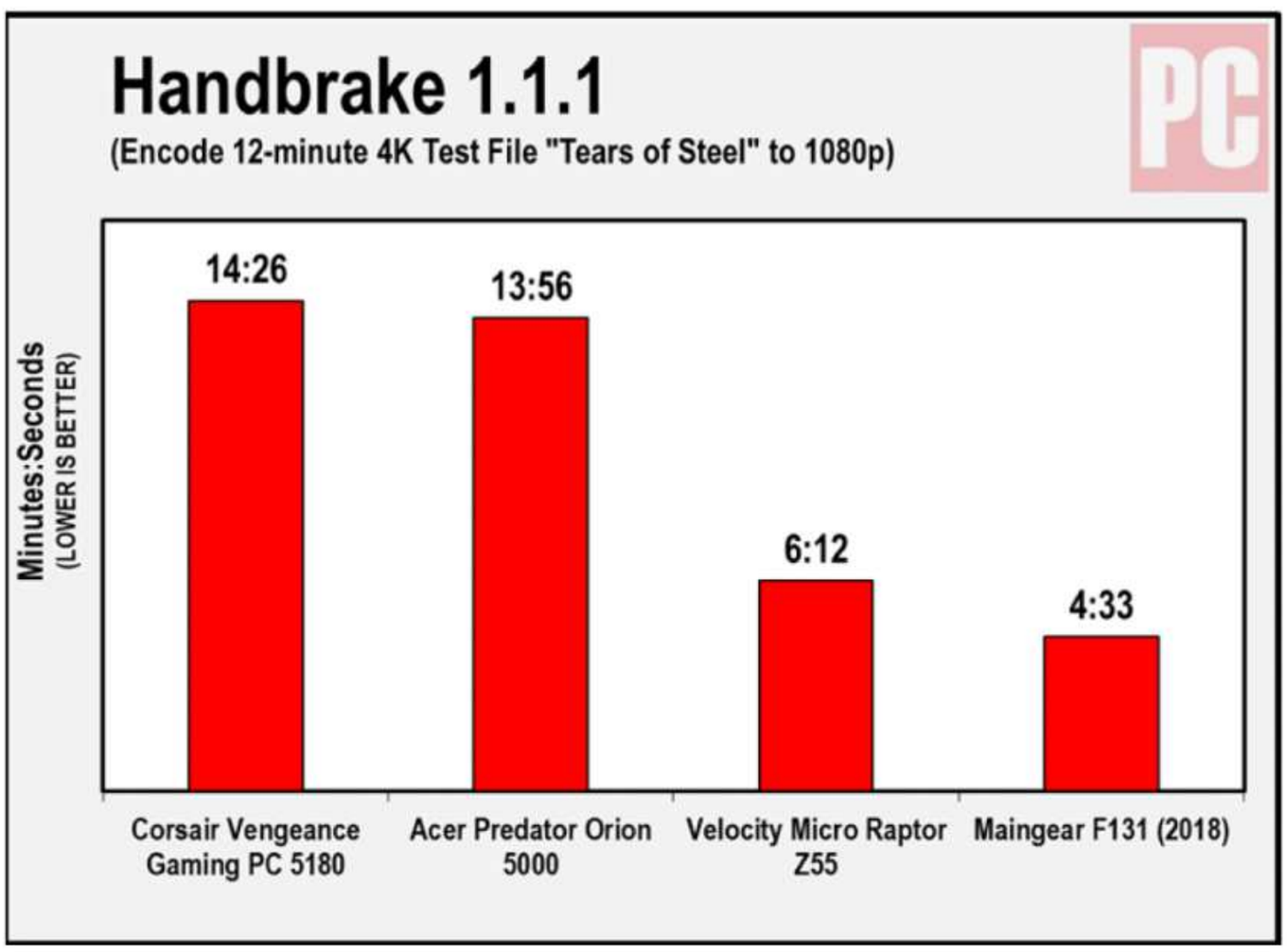
PRODUCT NAME	PROCESSOR	GRAPHICS	RAM & STORAGE
Corsair Vengeance Gaming PC 5180	Intel Core i7-8700 (3.2GHz)	Nvidia GeForce RTX 2080 (8GB)	16GB RAM; 480GB SSD, 2TB HDD
Acer Predator Orion 5000	Intel Core i7-8700K (3.7GHz)	Nvidia GeForce GTX 1080 (8GB)	16GB RAM; 500GB SSD
Velocity Micro Raptor Z55	Intel Core i7-8086K (4.0GHz)	Nvidia GeForce GTX 1080 Ti (11GB)	16GB RAM; 512GB SSD, 4TB HDD
Maingear F131 (2018)	Intel Core i9-7980X (2.6GHz)	Nvidia GeForce GTX 1080 Ti SLI (11GBx2)	32GB RAM; 1TB SSD, 4TB HDD

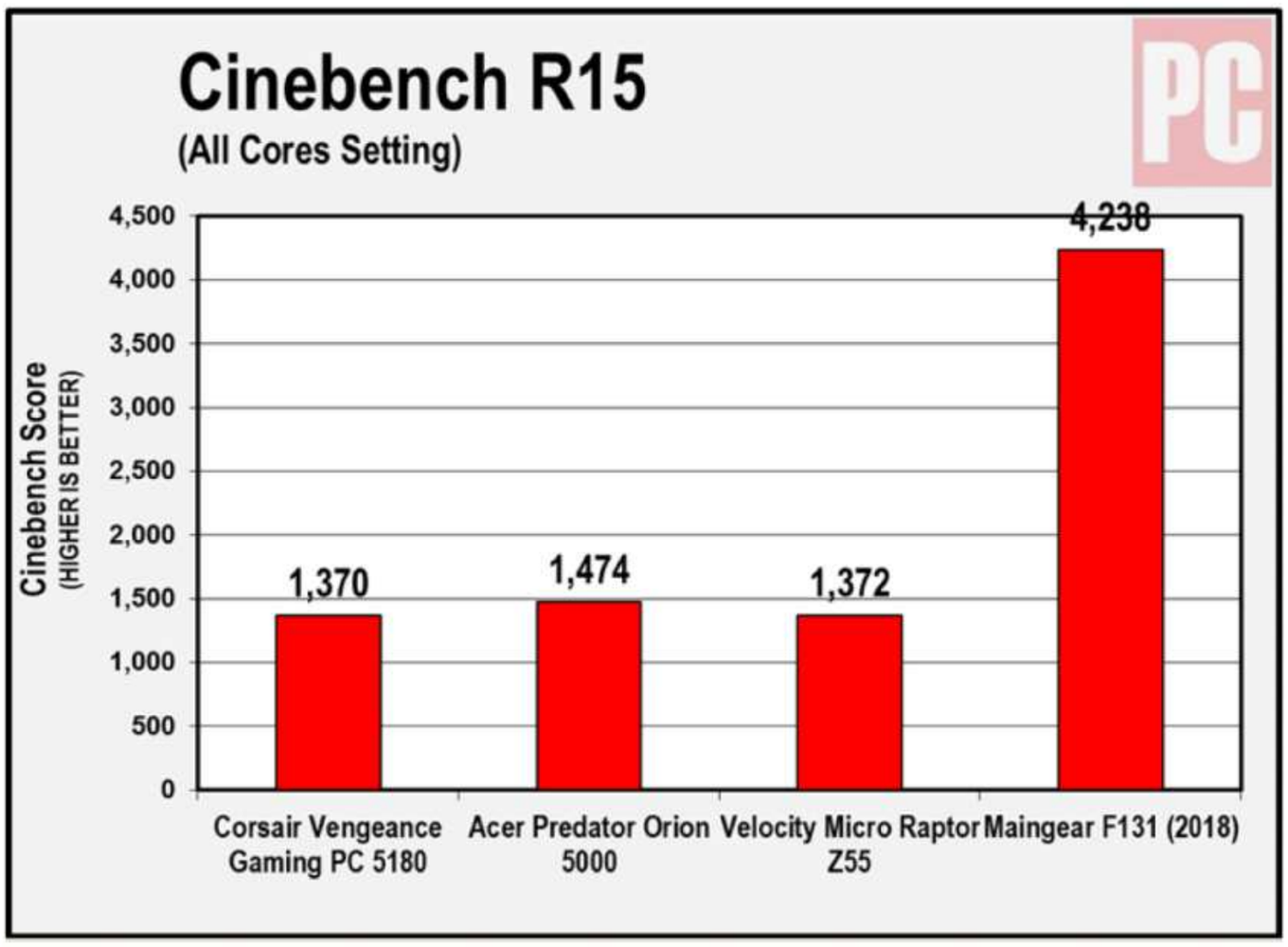
In this case, the most useful comparison we have new testing data for is the Acer Predator Orion 5000 (the $2,099.99 version we tested bears the very similar Core i7-8700K processor). For the sake of comparison and our charts, I've also included the Velocity Micro Raptor Z55 and the Maingear F131 to demonstrate where the i7-8700 stands in the bigger processor picture. All of these machines are speedy by any standard measure, but the Vengeance earned the highest score on the PCMark 10 general productivity test, despite the other three boasting superior CPUs.

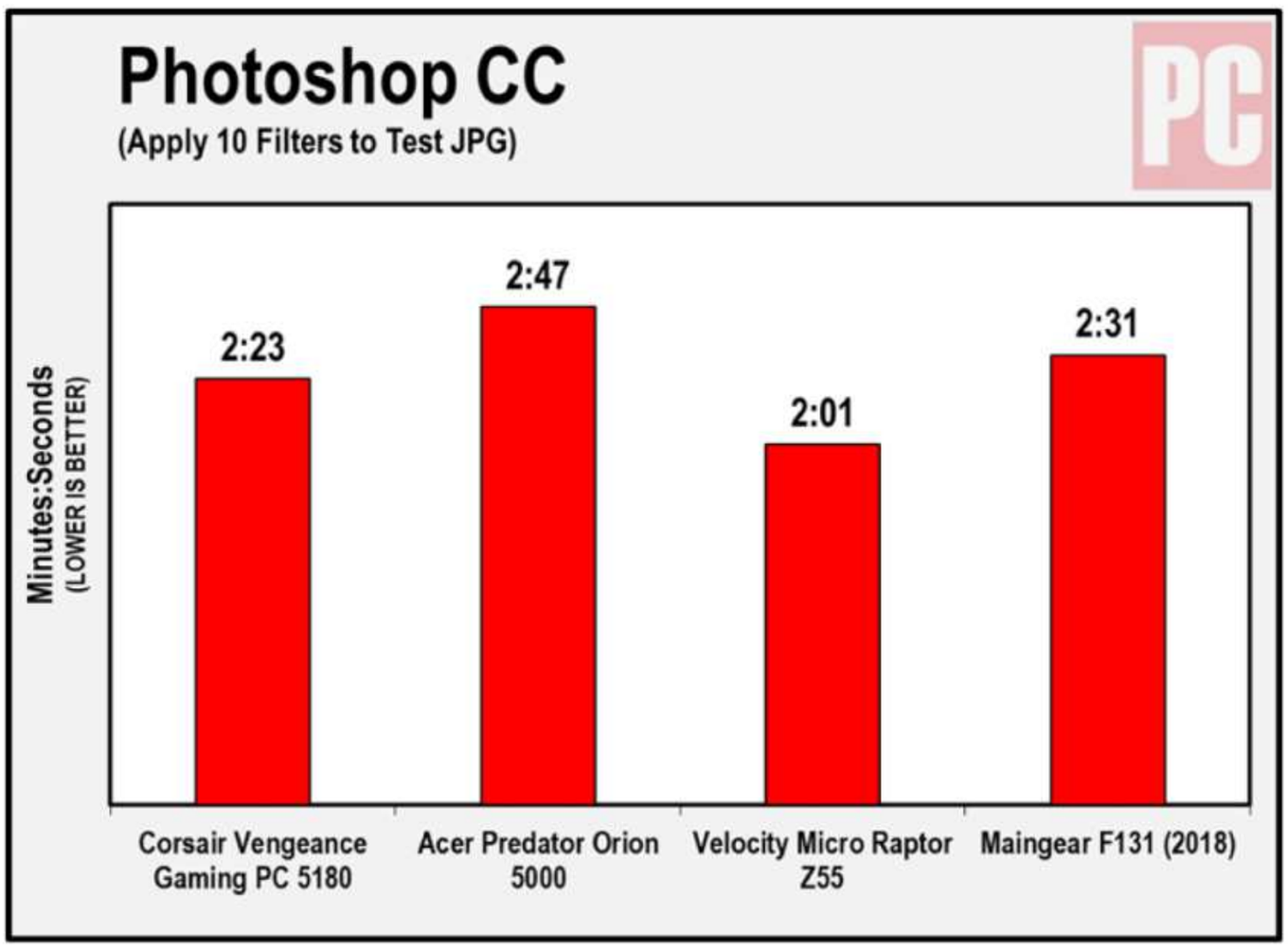


> **On these tests, despite the superior processors in the other two systems, the Vengeance stood up very well.**

On the more specialized multimedia tests, the Vengeance and the Orion 5000 traded blows, as you can see in the charts below. They went back and forth on Handbrake, Cinebench, and Photoshop, but even those differences were in the same ballpark, which makes sense given their similar CPUs. On these tests, despite the superior processors in the other two systems, the Vengeance stood up very well. There was a big disparity in Handbrake, where the much better processors performed, well, much better. The big exception is that the super-expensive Maingear totally ran away with the Cinebench test.

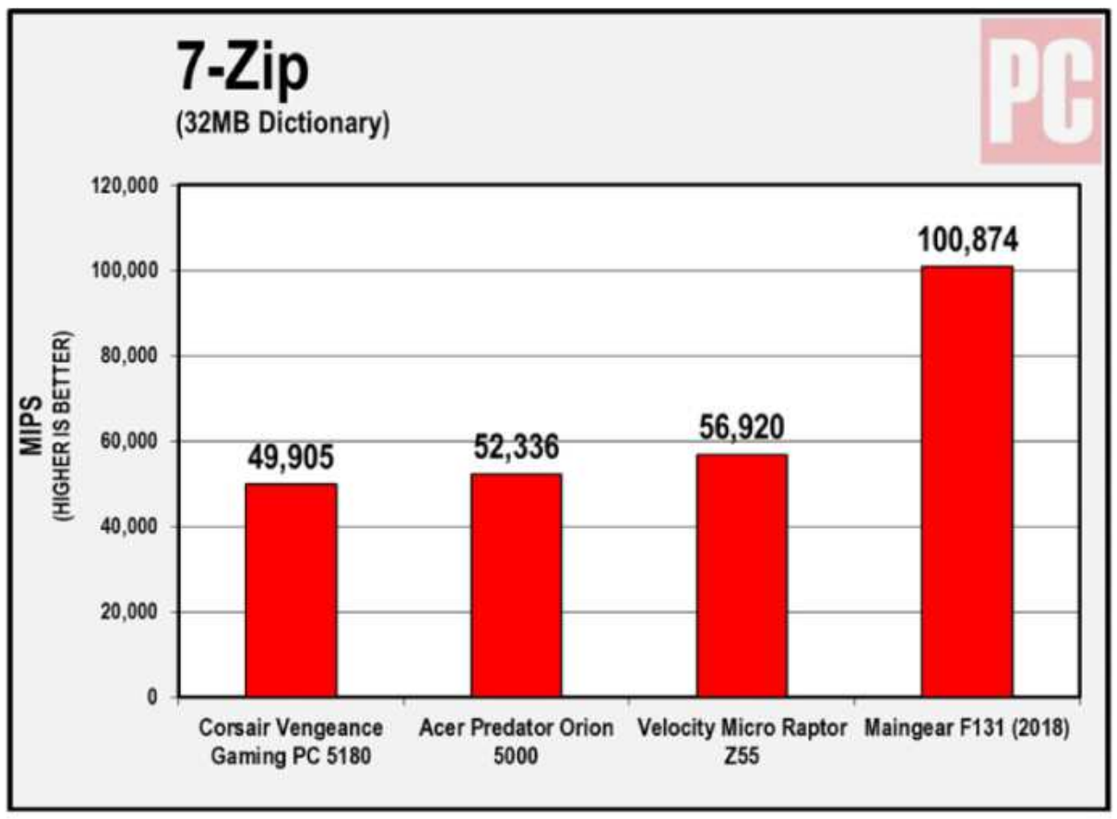




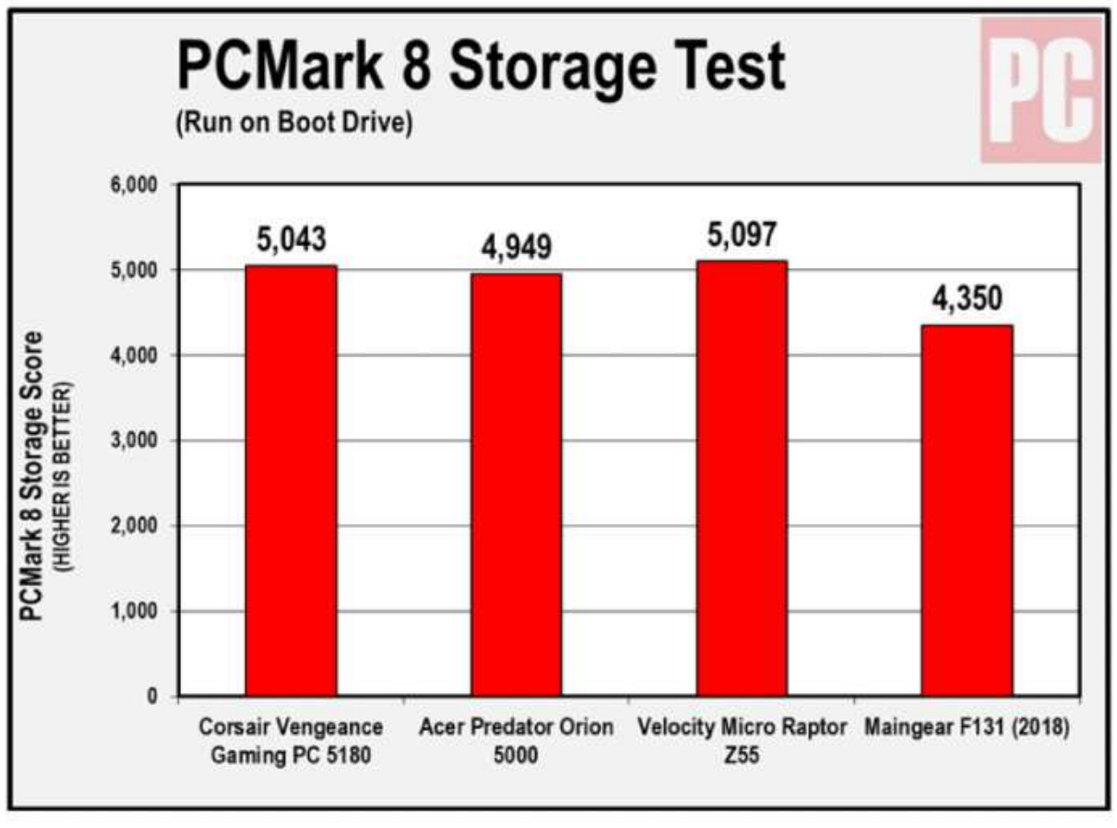


There was more of a gap between the i7-8700 and the i7-8700K on the 7-Zip test. You may be familiar with this program as a tool for compressing and decompressing files, and so it has a built-in benchmark for judging a system's speed at doing exactly that. The Orion 5000 was more capable in this regard, and on the whole, the speedier of the two. Still, they landed pretty close to each other, so it's a relatively minimal difference in practice. The premium Maingear F131, again, creamed the competition here.

> **In the instant lighting tab, you can configure the color and effects of the LEDs on the RAM, cooling block, and case.**



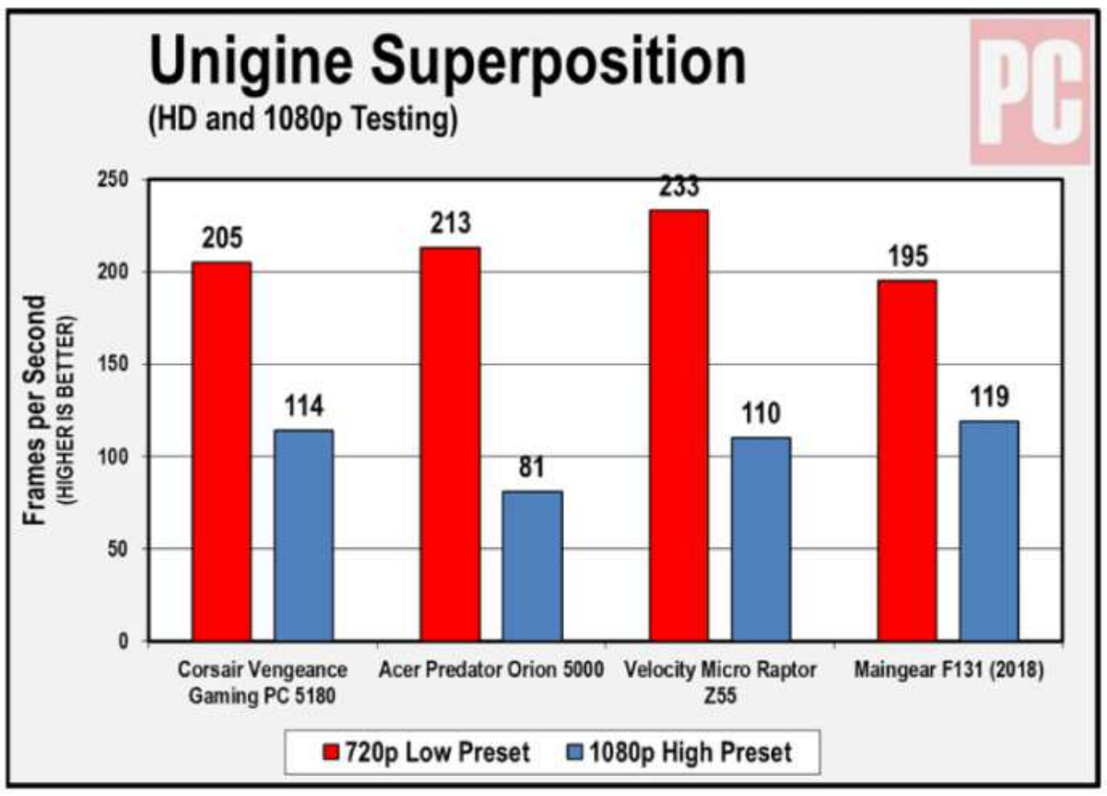
Separate from the other components is a computer's storage speed, which influences other loading times. The PCMark 8 Storage test judges the speed of a computer's drives, which is relevant for booting Windows, loading files, launching applications, and some gaming load times. In this regard, most of the desktops were on nearly the same level, with the Maingear's drive lagging behind slightly.

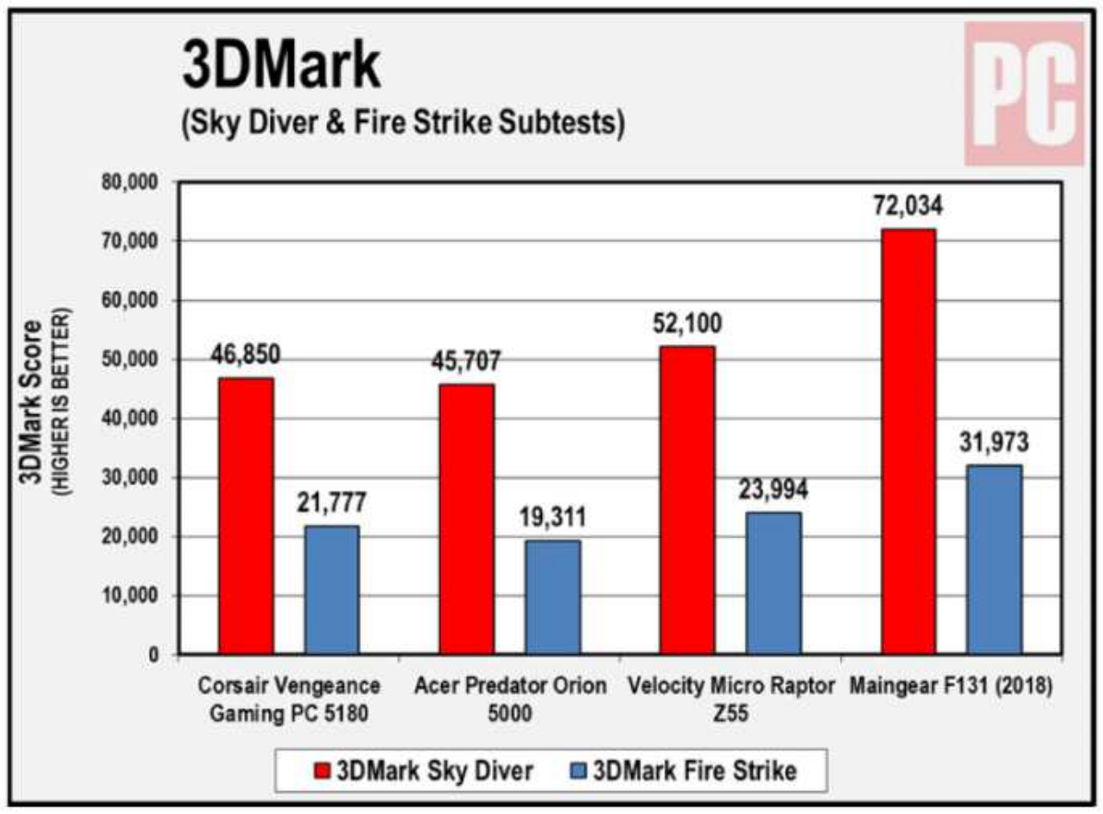


EXCELLENT GAMING PROWESS

3D tests come with the same caveats about our new tests, though there is more wiggle room. This is because frame rates, which are provided in both our synthetic (Superposition) and real-world (Far Cry 5 and Rise of the Tomb Raider's in-game benchmarks) game tests, are universally applicable and don't need to be compared directly against the same version of the same software to give you an idea of performance. This also gives us the first chance to see how the new Nvidia "Turing" RTX cards stack up against the previous generation in our new benchmark tests.

I ran the Superposition test at both the low and high presets, and the Vengeance more than held its own on both. The four machines stood neck and neck, and the Vengeance only lost to the Maingear on the more demanding settings (and not by much). It was a similar story on the 3DMark Sky Diver and Fire Strike tests, except the Maingear separated itself from the pack more substantially, and the Vengeance slightly trailed the Raptor Z55. Across the range of these synthetic tests, the Vengeance proved itself plenty capable.





We don’t have as much formalized data for the Far Cry 5 and Rise of the Tomb Raider tests yet, but the results we do have are pretty clear. Set to maximum settings and HD resolution, the Vengeance averaged 117fps (frames per second) and 159fps, respectively, in these two tests. That’s well over the 60fps target, with more than enough headroom for future proofing, and better than the Orion 5000’s 106fps and 125fps. You may be more interested in higher resolutions, though, and you’ll be pleased to hear the Vengeance excelled there. On the same tests set to 1440p, a demanding resolution, it averaged 105fps and 125fps.
4K is likely beyond what most people are aiming for, but even then, it pulled a

solid 53fps and 61fps. That means some frame dips below 60 will occur, but if you slide a few settings down, the experience is smooth. Even the much pricier esports-focused Asus ROG Strix desktop averaged 54fps on the same tests at 4K, while the Orion 5000 pulled 41fps and 47fps. The Raptor Z55 and its GTX 1080 Ti performed best with 54fps and 66fps. No matter how you slice it, the Vengeance is very capable for the three main resolutions for gaming. It's not quite a rock-solid 60fps machine for 4K, but few are, and getting that requires a much pricier graphics card or two.

No matter how you slice it, the Vengeance is very capable for the three main resolutions for gaming.

AN ALL-AROUND WINNER

When all's said and done, it's hard to find any real fault with the Corsair Vengeance. It's a performance beast in an attractive case that doesn't have a premium price. Yes, you could probably save some dough building a similar system yourself, but I'm comparing it with ready-to-buy prebuilts, which clearly have a market. Because of its speed, price, and feature set, it earns our Editors' Choice for midrange gaming desktops.

MATTHEW BUZZI

Asus ROG Strix GL12CX

Starts at $3,299.99; $3,799.99 as tested

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Asus ROG Strix GL12CX: First With Intel Core i9-9900K Processor

Like many spendy gaming desktops, the ROG Strix GL12CX is all-out racked and stacked for folks who take their play very seriously. With this rig, however, Asus targets the most enthusiastic of that lot: professional (or aspiring) esports players. While this jacked-up PC will please any gamer by powering through games at tip-top settings, its design and feature set target those seeking to maximize speed as much as tote-around convenience. That dual focus levies a price premium, but you do get gaming prowess by the bucket: The GL12CX serves as our first look at Intel's spanking-new Core i9-9900K processor, and it packs a fresh Nvidia GeForce RTX 2080 graphics card, too—taken together, a mouthwatering proposition for anyone. If the machine's look and design don't grab you but you have a big budget, high-end configurable options such as the Origin PC Neuron and Velocity Micro Raptor Z55 may pack more punch.

FOCUSED ON ESPORTS, FOR BETTER OR WORSE

Unlike some desktops brimming with power, the ROG Strix GL12CX is on the compact side, at 18 by 7 by 15.7 inches (HWD). The speediest machines often have the bulk to match; witness the XXL-size Acer Predator Orion 9000 and the slightly downsized Velocity Micro Raptor Z55. The ROG Strix is not truly small-form-factor, like one of Falcon Northwest's Tiki or MSI's Trident machines, but more in line with manageable systems such as the Dell Inspiron Gaming Desktop and Lenovo Legion Y520 Tower.

The tower is a mix of materials: The front face and top are plastic, while the side panels and rear are metal, which makes the chassis surprisingly heavy at 24.3 pounds. The front panel has a somewhat busy design, with a crisscrossing line pattern on the bottom and a plainer top half accented by customizable LED strips. A magnetic detachable plate covers the top portion of the front face, hiding an optical drive and a hot-swap SSD bay. When you're not using these, or when you're done accessing them, you can snap the cover back into place—which is good, since the chassis looks much nicer with the bay accesses covered.

Asus ROG Strix GL12CX

PROS Powerful performer with cutting-edge 9th Generation Core, Nvidia RTX parts. Compact design. Restrained-but-customizable chassis LEDs. Bundled mouse and keyboard are a cut above.

CONS Expensive. Niche target audience. Tight squeeze for maintenance and expansion.

The SSD bay is a curious feature for the average user, though I could see a few niche uses for it. According to Asus's marketing materials, it's included specifically with professional esports players in mind. The bay is a small metal tray for a 2.5-inch hard drive or SSD; you drop in a drive (no tools needed, though you can screw it down if you like) and slide it in or out of the front of the case. No drive comes installed by default, but you could pull out the tray and swap in a new drive without opening the side panels. While the pros can use it, with a 2.5-inch SSD, to bring their profiles and settings with them between booths at competitions, that scenario doesn't exist for most other folks. If you do happen to have a different scenario that requires you to switch SSDs frequently, though, this was built just for you!

Inside the case are more standard (and useful) design touches. Getting inside is easy—either side panel pulls away after you remove its two rear screws. Both panels are opaque metal by default, but Asus also includes an optional clear-plastic door for the left side so you can see into your system. There's good reason to do this, because there's a modest light show going on inside and some nice parts you might as well be able to see. It's not much of a tinkerer's case: You could swap out any of the components since it's a not a bespoke system, but it's really designed to be plug-and-play.

That said, should you go tweaking inside, you won't find much room to maneuver; but at least everything is tucked away neatly. A metal bar runs horizontally across the interior, serving as a stabilizing brace for the graphics card (important, given this case's intended portability) and a holder for an LED strip that shines from its back edge onto the card. A large black shroud covers the power supply and bottom portion of the case, funneling cool air in from a dedicated front fan and out the rear while hiding much of the cable mess. The rest of the case is cooled by another front fan and a small rear fan.

THE CORE OF THE MATTER

As for the components packed inside, you can easily see what drives our test configuration's price close to four large. The centerpiece is the Core i9-9900K, Intel's new flagship processor in its 9th Generation mainstream desktop CPU line. It's the first Core i9 chip that's part of the main consumer platform and not the enthusiast Core X-Series family, which by itself may be enough to turn some heads.

This is a killer chip for multithreaded applications: an eight-core, 16-thread CPU capable of boosting to up to 5GHz, a feature Intel is specifically touting as useful for gaming (going so far as to dub it the "world's best gaming processor"). It's beneficial not just for gaming itself but also for multi-taskers who may be streaming while playing or doing other CPU-intensive tasks.

It’s the only chip among the initial 9th Generation Core releases that supports Hyper-Threading.

Also worth noting: It’s the only chip among the initial 9th Generation Core releases that supports Hyper-Threading. With the launch of 9th Generation on the desktop, Intel removed that feature from the Core i7 and inserted it only at the Core i9 level, which may leave some shoppers disgruntled. To keep it running cool, a Cooler Master MasterLiquid Pro 120mm closed-loop liquid cooler is installed with a nifty clear cover over the CPU heat sink. Hardware tweakers will want liquid cooling on a system using this chip; the reviewer of the Core i9 found that for any kind of aggressive overclocking, liquid was a big help.

Alongside the chip is the still-fresh Nvidia GeForce RTX 2080 graphics card, an Asus version. While these new pieces of hardware may offer only a moderate upgrade for those already rocking a GeForce “Pascal” card, they are still downright powerful in their own right.

Asus also packed 32GB of DDR4 memory in our build alongside a 512GB M.2 solid-state drive and a separate 2TB platter-based hard drive. The M.2 SSD is configured in unusual, Asus-specific fashion: It’s mounted vertically in what Asus calls a “DIMM.2” slot next to the memory slots, much like a stick of RAM.

This vertical arrangement makes it easier to access and helps the module run cooler. (Most of the time, M.2 SSDs get installed flat against the motherboard, and often in the shadow of a hot graphics card.) The housing for the DIMM.2 module is also equipped with some low-key mood LEDs, rounding out the system glow.

The case doesn't have much more room for additions. In total, you get one M.2 connector for Wi-Fi, two more for M.2 SSDs, two DIMM slots, and the empty front-face SSD tray. As configured, you have no RAM slots free, and a single PCI Express x16 slot means no physical room for two graphics cards. Asus also sells a $3,299 base model with a ticked-down Core i7-9700K CPU, half the memory (16GB), the same GeForce RTX 2080, and a half-size (256GB) SSD with the same 2TB hard drive.

ON-POINT PORTS, SUPERIOR PERIPHERALS

When you take into consideration all the peripherals that an enthusiast gamer needs, the ROG Strix offers plenty of ports for a chassis this size. On the front panel are four USB Type-A ports (two each of USB 2.0 and 3.1), an audio jack, and an SD flash-card reader.

Around back are two more USB 2.0 ports, four USB 3.1 ports, and two USB 3.1 Gen 2 ports (all Type-A). Also here are an HDMI-out connection (for the Core chip's integrated graphics, unused in favor of the RTX card's outputs), an Ethernet jack, and the usual surround-capable audio lines and S/PDIF. The GeForce RTX card supplies three DisplayPort outputs and one HDMI.

The ROG Strix also comes with a gaming mouse and a mechanical keyboard, both Asus-branded. Both are a cut above the usual and RGB-lit. The ROG Strix Flare Mechanical is a nice metal keyboard adorned with per-key LED lighting, true Cherry MX key switches, and a glowing underbelly, as well as media controls. It feels nice to type on, certainly much better than the average PC pack-in peripheral. The mouse, the ROG Gladius II, is a bit more basic but still much nicer than average. It features a 12,000dpi sensor, interchangeable switches, and plenty of LED bling.

“The mood lights on both peripherals and the case’s mood lighting can be synchronized using Asus’ Aura lighting.”

The mood lights on both peripherals and the case's mood lighting can be synchronized using Asus' Aura lighting via the included Armoury software. The lighting scheme also has a special connection with the blockbuster title Call of Duty: Black Ops 4, in that the RGB can automatically display unique hotkey lighting and indicators. This isn't exactly useful, but it's a neat gimmick that doesn't have any downside.

Still, the ROG Strix levies a cost premium. The CPU and GPU are obviously pricey, and the rest of the components are no slouches, but it's still a little expensive considering the whole package. The chassis isn't especially luxe. The pre-built nature will please shoppers seeking such simplicity, but it, too, amps up the cost. The target buyer here is not the average shopper or gamer looking for top value; it's a gamer seeking a compact desktop that can game all-out, and right now.

I9 PLUS RTX EQUALS... WELL, IT'S VERY FAST

With this tantalizingly high-end hardware, all eyes are on performance. It should be no surprise that by any objective measure, the Core i9-9900K is lightning-fast. Whether you should specifically choose one to center your build around for best value is a question better answered by our standalone review of the chip. Briefly, it's super-fast and won't be a bottleneck for your games, though the last-gen Core i7-8700K is no slouch, either. But I'll happily talk about the speed it demonstrates for this system.

“It should be no surprise that by any objective measure, the Core i9-9900K is lightning-fast.”

On the PCMark 8 Work Conventional test, the ROG Strix GL12CX scored a wildly high 4,224 points, one of the loftiest showings we've recorded. The Velocity Micro Raptor outscored it despite being built around a slightly older Core i7-8086K Limited Edition CPU, which says more about how this particular test doesn't take full advantage of the slightly superior chip.

PC PERFORMANCE TESTS

Product	Processor	PCMark 8 Work Conventional ▲	MULTIMEDIA	Handbrake 0.9.9 ▼ min:sec	CineBench R15 ▲	Photoshop CS6 ▼ min:sec
Asus ROG Strix (GL12CX)	Intel Core i9-9900K (3.6GHz)	4,224		0:25	2,082	2:12
Acer Predator Orion 5000	Intel Core i7-8700K (3.7GHz)	4,073		0:33	1,474	2:45
Acer Predator Orion 9000	Intel Core i9-7980XE (2.6GHz)	3,692		**0:22**	**3,715**	2:39
Alienware Area-51 Threadripper Edition	AMD Ryzen Threadripper 1950X (3.4GHz)	3,330		0:28	3,047	3:44
Origin Neuron	Intel Core i7-7700K (5.0GHz)	4,271		0:42	1,074	2:06
Velocity Micro Raptor Z55 (2018)	Intel Core i7-8086K (4.0GHz)	**4,293**		0:35	1,372	**2:01**

▲ High scores are best ▼ Low scores are best **Bold** denotes winning score RED denotes Editors' Choice

The multimedia tests do better at flexing the Core i9-9900K's muscle: Its Handbrake, Cinebench, and Photoshop results are topped or matched in this group only by counterparts using Core i9 X-Series Extreme Edition or AMD Ryzen Threadripper 1950X chips. As you can see, the Core X-Series contender still outclassed the Core i9-9900K in a few other areas. The results in the chart really tell you what to need to know on their own, with a Core i7-8700K and a GeForce GTX 1080 included for context courtesy of the Acer Predator Orion 5000. The Core i9's performance is no doubt better than this, but whether enough to be worth the added cost is a different question. As I said, though, that's a discussion better fitted for the individual chip reviewed, tested in the same testbed rather than in differently configured systems.

The 3D capability of this system is also worth special attention. While not quite as minty-fresh as the processor, Nvidia's late-2018 "Turing" platform is still the very new kid on the block in the graphics-card world, and we're still getting a sense of what to expect from the new hardware. I mentioned earlier that the 20-series cards may be of questionable value to those already running a GeForce GTX 10-series model, but there's clearly an uptick in performance, and both the GeForce RTX 2080 and the truly elite-level RTX 2080 Ti are objectively powerful. The ROG Strix's GeForce RTX 2080 card handily bettered the GeForce GTX 1080 on our tests, from the synthetic 3DMark benchmarks to the game simulations Heaven and Valley. It's worth noting that a lot of the head-to-head comparisons are a bit unfair to the ROG Strix, as the pricey competitors that had comparable processors were dual-card systems, whereas the Strix has only one RTX card.

PC PERFORMANCE TESTS

		3D ▲		GAMING (frames per second) ▲			
		3DMark		Heaven		Valley	
Product	Graphics Chipset	Cloud Gate	Fire Strike Extreme	Medium quality 1,366 x 768 AA Off	Ultra quality Native AA 4X	Medium quality 1,366 x 768 AA Off	Ultra quality Native AA 4X
Asus ROG Strix (GL12CX)	Nvidia GeForce RTX 2080 (8GB)	**59,459**	12,251	370	163 (1080p); 45 (4K)	207	161 (1080p); 48 (4K)
Acer Predator Orion 5000	Nvidia GeForce GTX 1080 (8GB)	45,031	9,940	303	132 (1080p); 31 (4K)	181	136 (1080p); 40 (4K)
Acer Predator Orion 9000	Nvidia GeForce GTX 1080 Ti SLI (11GBx2)	42,729	21,373	246	215 (1080p); 83 (4K)	133	132 (1080p); 94 (4K)
Alienware Area-51 Threadripper Edition	Nvidia GeForce GTX 1080 Ti SLI (11GBx2)	43,480	20,518	181	170 (1080p); 84 (4K)	95	91 (1080p); 80 (4K)
Origin Neuron	Nvidia GeForce GTX 1080 Ti SLI (11GBx2)	41,740	**21,481**	308	**278 (1080p); 95 (4K)**	174	**175 (1080p); 113 (4K)**
Velocity Micro Raptor Z55 (2018)	Nvidia GeForce GTX 1080 Ti (11GB)	50,953	13,315	**387**	169 (1080p); 45 (4K)	**226**	177 (1080p); 54 (4K)

▲ High scores are best ▼ Low scores are best **Bold** denotes winning score RED denotes Editors' Choice AA = *Anti-aliasing*

This is the first opportunity, though, that we've had in PC Labs to see what the GeForce RTX 2080 can do in a pre-built system, so I ran the tests at the full range of popular resolutions. Its 1080p numbers are, of course, stratosphere-high. If you're playing on only a 1080p/HD monitor and prioritize frame rates over all else, the results of 163 frames per second (fps) and 161fps on Heaven and Valley at Ultra quality settings show that the GeForce RTX 2080 is way more than capable—it's frame-rate gluttony. When I bumped up the resolution to 1440p (2,560 by 1,440 pixels), those frame rates dropped to 99fps and 104fps, respectively. Not bad, even when you're running a high-refresh-rate monitor in excess of 60Hz.

Playing at 4K (3,840 by 2,160 pixels), as always, is an entirely different animal. The ROG Strix managed only 45fps and 48fps on the same settings. Heaven and Valley were a bit harsher than some real-world tests, possibly due to lack of DirectX 12 support. So I fired up a couple of late-model, demanding AAA games.

On Far Cry 5 and Rise of the Tomb Raider, with each game set to the maximum detail preset and 4K resolution, the ROG Strix scored 54fps on each—better, but still short of the ideal consistent 60fps. There's a reason few gamers even bother aiming for 4K gaming, as it's simply too demanding for all but the priciest hardware or dual-card systems. Full HD (1080p) and 1440p are much more common gaming resolutions for a reason, and the ROG Strix handles them with aplomb. Popular esports titles (namely MOBAs and shooters) are less concerned with sky-high resolutions and extreme fidelity, anyway; in competitive games like these, it's all about smooth performance in the form of high frame rates. On that front—for its target audience—the ROG Strix excels.

“Few gamers even bother aiming for 4K gaming; it's simply too demanding for all but the priciest hardware.”

AN "A" FOR ESPORTS PROS; OTHERS, SHOP SMART

The ROG Strix GL12CX does what it says: It's a cutting-edge, full-featured gaming desktop aimed at close-to-the-edge enthusiasts and serious esports players. That means it is very fast, it is very expensive, and it has some features the average user simply doesn't have much use for.

It is very fast, it is very expensive, and it has some features the average user simply doesn't have much use for.

You can find more economical (and honestly, spiffier and flashier) ways to spend $3,800 on a computer, so we would suggest comparison-shopping even if you're smitten. If you do fall into the target audience, such as being a buyer of a passel of PCs for an esports team, play facility, or tournament, the ROG Strix GL12CX will deliver an effective plug-and-play solution that also looks great when the cameras pan over it. Alternatives in this costly range come in the form of highly configurable boutique systems, meaning your decision largely comes down to which case design you like the most. As such, if you're considering the Strix, also do your due diligence: Take our exact review configuration's prices with a grain of salt, and pick the right parts for your budget and needs from among our favorites, such as the Origin PC Neuron, the Falcon Northwest Talon, the Velocity Micro Raptor Z55, and the Origin PC Genesis. See which one delivers the best balance for what you actually need. The answer may surprise you.

MATTHEW BUZZI

Microsoft Surface Pro 6: Small Changes, Still a Top Choice

Microsoft Surface Pro 6

$899.00

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PC MAGAZINE EDITORS' CHOICE

Microsoft's Surface line broke the mold when it burst onto the scene in 2013, delivering on the vision of a streamlined, transformable laptop-tablet hybrid running the full Windows operating system. Each iteration has seen only modest changes—but it has remained the benchmark for the development of the detachable 2-in-1. The Surface Pro 6 (starts at $899; $1,199 as tested) is perhaps the softest update yet, with only two key changes from its predecessor. The 2-in-1 now comes in all black, an alternative to its long-running steely gray, and it features an 8th Generation Intel processor for improved performance. These aren't big changes, but the Pro 6 is a tick faster, and the black color looks sharp. While still excellent, though, its lack of changes means it fails to move past the Lenovo ThinkPad X1 Tablet as our Editors' Choice, which had seized the title from the previous Surface Pro.

BLACK IS THE NEW BLACK

Though the color shift is completely aesthetic, it lends a sleeker look to an already slick design. Fittingly for the product's name, the color also makes it look more professional. If that's how you'll use your 2-in-1, you may very well appreciate the look—if not, you can also buy it in its original "platinum."

Despite looking thinner, when you put the calipers on it, the Surface Pro 6 is no slimmer than the previous edition. At 0.33 by 11.5 by 7.9 inches (HWD) and 1.7 pounds, it's still a compact machine, though. At this size, the Pro 6 is perfectly portable and functional. It's still lighter and slimmer than the Editors' Choice Lenovo ThinkPad X1 Tablet (0.35 by 12 by 8.9 inches and 1.96 pounds) and the Dell Latitude 5290 2-in-1 (0.42 by 11.5 by 8.2 inches and 1.89 pounds).

The display is identical to that of the previous edition—it's gorgeous. The 12.3-inch screen comes in a 3:2 aspect ratio, different from the more standard 16:9, and as such bears an unusual 2,736-by-1,824-pixel resolution. That's a higher-than-HD resolution and looks very sharp. The display has great viewing angles, and it gets super bright at maximum settings, with colors looking especially vibrant.

Microsoft Surface Pro 6

PROS Speedy 8th Generation Intel processor. Good battery life. Premium feel. Sleek all-black color option. Brilliant display. Well-implemented kickstand.

CONS Minimal changes from previous model. As ever, keyboard sold separately. Not ideal for in-lap use. Somewhat restrictive configuration

Since it’s a tablet, the screen, of course, offers touch technology. This is convenient for poking around in Tablet mode or tapping the screen lazily when you’re using the keyboard and touchpad. It’s also good for stylus use: The Surface Pen ($99) is sold separately and attaches to the side of the display magnetically. It’s a good place to put the pen while you’re working, though it doesn’t take much to knock it loose.

BEST-IN-CLASS CONVERTIBILITY WITH A FEW CAVEATS

Because there are no physical changes, the Surface Pro’s trademark convertibility is also unchanged. The built-in rear kickstand, which has been copied since its debut, is executed just like on the previous model. A fully adjustable hinge lets you recline the screen through 165 degrees of range, including almost nearly flat, which can be helpful when you’re using the stylus for sketching or note-taking. The original Surface models featured a hinge with a limited number of set adjustment points, so this system is preferable.

The kickstand is just half the battle in turning the Surface Pro 6 (technically a tablet) into a laptop. The Surface Type Cover—the detachable keyboard also subject to many copycats over the years—is what makes the magic happen. The keyboard easily attaches to the bottom of the Surface Pro magnetically, making transformation a breeze.

The Type Cover is still sold separately. This has been a complaint of mine and of plenty of others since the Surface hit the market. The Surface Pro is already pricey, but adding another $129 to get what feels like full functionality is a bitter price pill. The keyboard is an integral part of the experience—Microsoft rarely shows or advertises the two apart. Without it, the Surface Pro is really just a nice, expensive tablet. The Type Cover should really be included to deliver fully on the device's concept.

Despite its thinness, the Type Cover offers a surprisingly comfortable typing experience with good key travel. It has adjustable backlighting, too. The keyboard feels a little flimsy if you press down too much, especially if you're not using it on a desk, but it's still more than serviceable and one of the best among all detachables.

You can adjust the keyboard for a more comfortable typing angle by folding the top up against the screen, where more magnets hold it in place. This innovation was introduced to the Surface line several iterations ago; it's a small addition that makes a noticeable usability difference. The touchpad is also excellent and tracks very smoothly.

While the kickstand setup works great on a desk, it still leaves something to be desired in your lap. While writing this review on the device, I tried sitting cross-legged on the couch, and there's simply no good way to support the kickstand and still be able to see the screen and type comfortably. It's better with your feet on the floor, since the kickstand can straddle your thighs, but it still doesn't replicate the stability of a traditional laptop screen and keyboard.

One of the Pro 6's bigger disappointments is the array of ports; calling it an "array" seems generous. Not counting the audio jack and proprietary power connector, you get just three connections on the Surface Pro 6: a USB 3.0 port, a Mini DisplayPort, and a microSD card slot. More than one USB port would be useful when you're using multiple peripherals (such as a mouse and an external drive), but the exclusion of a USB Type-C port is disappointing. The technology is no longer new, and it should be included by default as more and more devices and systems adopt it. The ThinkPad X1 Tablet, for example, has two USB Type-C ports, and they even offer Thunderbolt 3 support.

Mini DisplayPort is useful for external video output, but it's not one of the more common connections; full DisplayPort or HDMI would be more useful. The microSD slot is a helpful inclusion for file transfers, especially for media pros. On the whole, though, this premium device should come with a few more (or more useful) ports than it does.

UNLOCKING THE CONFIG CONUNDRUM

When you're ordering your Surface Pro 6, you'll have several combinations of processor, memory, and storage to choose among. It's not all that simple, however—you can't combine just any component option with any other. Microsoft guides you along starting with memory (8GB or 16GB), which dictates which processor (8th Generation Intel Core i5 or Core i7) and storage (128GB, 256GB, 512GB, or 1TB solid-state drives) you can choose.

The color of your Surface Pro 6 depends on its components, though I couldn't unlock the rhyme or reason behind the combinations. For example, you can configure the black model with 16GB of memory and a Core i7 CPU, but you can only choose the 512GB SSD, while the platinum model can pair with a 512GB or 1TB drive. Some other limitations make a bit more sense: for example, 16GB of memory is available only with a Core i7 CPU, both of which suit power users.

Prices vary greatly depending on components, starting at $899 for 8GB of memory, a Core i5 processor, and 128GB of storage. Our review unit was outfitted with 8GB of memory, a Core i5 CPU, and the 256GB SSD for $1,199. The priciest possible configuration (16GB of memory, a Core i7 CPU, and a 1TB SSD) is $2,229.

PERFORMANCE TESTING: A GENERATIONAL JUMP

This middle-of-the-road review unit I have on hand isn't the most powerful one, with its Core i5 processor, but generally, Intel's newest generation of chips is snappy. Because even the mainstream chips in Intel's 8th Generation boast four cores, the Surface Pro 6 crosses the finish line as one of the first 2-in-1s with a quad-core processor. The particular CPU in this model is the Core i5-8250U, the U-series being a power-sipping, efficient family meant for mobile use. (The Core i7 option is also a U-series chip.)

In general use, the device was perfectly snappy. I was able to open many web browser tabs, run Spotify, and manage word processing without any slowdown or noticeable lag. If your use case includes similar tasks and nothing much more strenuous, you shouldn't have any speed complaints.

On the PCMark 8 Work Conventional test, which quantifies the sort of work mentioned above as well as general office tasks, the Surface Pro 6 scored in line with the competition. Those that outperformed it in our competitive set here, such as the Dell Latitude and Lenovo IdeaPad Miix 520, have less-demanding 1080p resolutions that are responsible for much of that gap.

That said, these were also superior on the multimedia tests, just with less of a gap. The Surface Pro 6 is neck-and-neck with the ThinkPad X1 Tablet, which makes sense as they share a processor, but the Latitude and IdeaPad Miix 520 edge it out across the board. Just a note that I've included the Surface Pro with LTE Advanced as the comparison in the chart instead of the Surface Pro 5. This is because the two are virtually identical in design (the LTE model is essentially a Surface Pro 5 with cellular service added), but the LTE unit we reviewed has a more comparable Core i5 as opposed to the Surface Pro 5's Core i7, making it a more useful 1:1 generational comparison with our Surface Pro 6.

PERFORMANCE TESTS

Product	Processor	PCMark 8 Work Conventional ▲	MULTIMEDIA	Handbrake 0.9.9 ▼ min:sec	CineBench R15 ▲	Photoshop CS6 ▼ min:sec	Battery Rundown hr: min ▲
Microsoft Surface Pro 6	Intel Core i5-8250U (1.6GHz)	2,891		1:21	554	3:27	**14:38**
Dell Latitude 5290 2-in-1	Intel Core i5-8350U (1.7GHz)	**3,436**		1:20	600	**3:13**	10:36
Lenovo IdeaPad Miix 520	Intel Core i5-8250U (1.6GHz)	**3,436**		**1:18**	**606**	3:20	7:32
Lenovo ThinkPad X1 Tablet (3rd Gen)	Intel Core i5-8250U (1.6GHz)	2,873		1:22	542	3:22	8:49
Microsoft Surface Pro with LTE Advanced	Intel Core i5-7300U (2.6GHz)	2,878		1:58	366	3:44	13:15

▲ High scores are best ▼ Low scores are best **Bold** denotes winning score RED denotes Editors' Choice

> **I was able to open many web browser tabs, run Spotify, and manage word processing without any slowdown.**

If you plan to do more serious or professional work on the Surface Pro 6, perhaps you should consider 16GB of memory or the Core i7 model. This configuration is quick enough for general use, but I didn't find it especially fast for more serious work. To be clear, that's not exclusive to the Surface Pro 6 in this category—after all, it's ahead of or level with the other systems—but to the tier of performance as a whole. No, a professional media creator ideally wouldn't use a small system like this as his or her main machine, but it could be tempting as a viable portable option, so you should know what to expect.

Where the Core i7 model won't help you is 3D performance. All of these systems (the Core i7 version included) work off the integrated graphics of the CPU only, with no discrete graphics cards for modeling, animation, or gaming. If any of those tasks or similar work are your main needs, you should look in a different category. Some light gaming (2D games, simpler or less action-heavy) should be possible on the machine, but expect to run anything 3D at low settings and non-native resolution.

PERFORMANCE TESTS

		3D ▲		GAMING (frames per second) ▲			
		3DMark		Heaven		Valley	
Product	Graphics Chipset	Cloud Gate	Fire Strike Extreme	Medium quality 1,366 x 768 AA Off	Ultra quality Native AA 4X	Medium quality 1,366 x 768 AA Off	Ultra quality Native AA 4X
Microsoft Surface Pro 6	Intel HD Graphics 620	8,443	**544**	18	1	**28**	2
Dell Latitude 5290 2-in-1	Intel UHD Graphics 620	**8,622**	533	21	**5**	26	**5**
Lenovo IdeaPad Miix 520	Intel UHD Graphics 620	7,864	438	21	**5**	23	**5**
Lenovo ThinkPad X1 Tablet (3rd Gen)	Intel UHD Graphics 620	8,015	528	**23**	2	**28**	2
Microsoft Surface Pro with LTE Advanced	Intel HD Graphics 620	5,956	412	19	2	19	2

▲ High scores are best ▼ Low scores are best **Bold** denotes winning score RED denotes Editors' Choice AA = *Anti-aliasing*

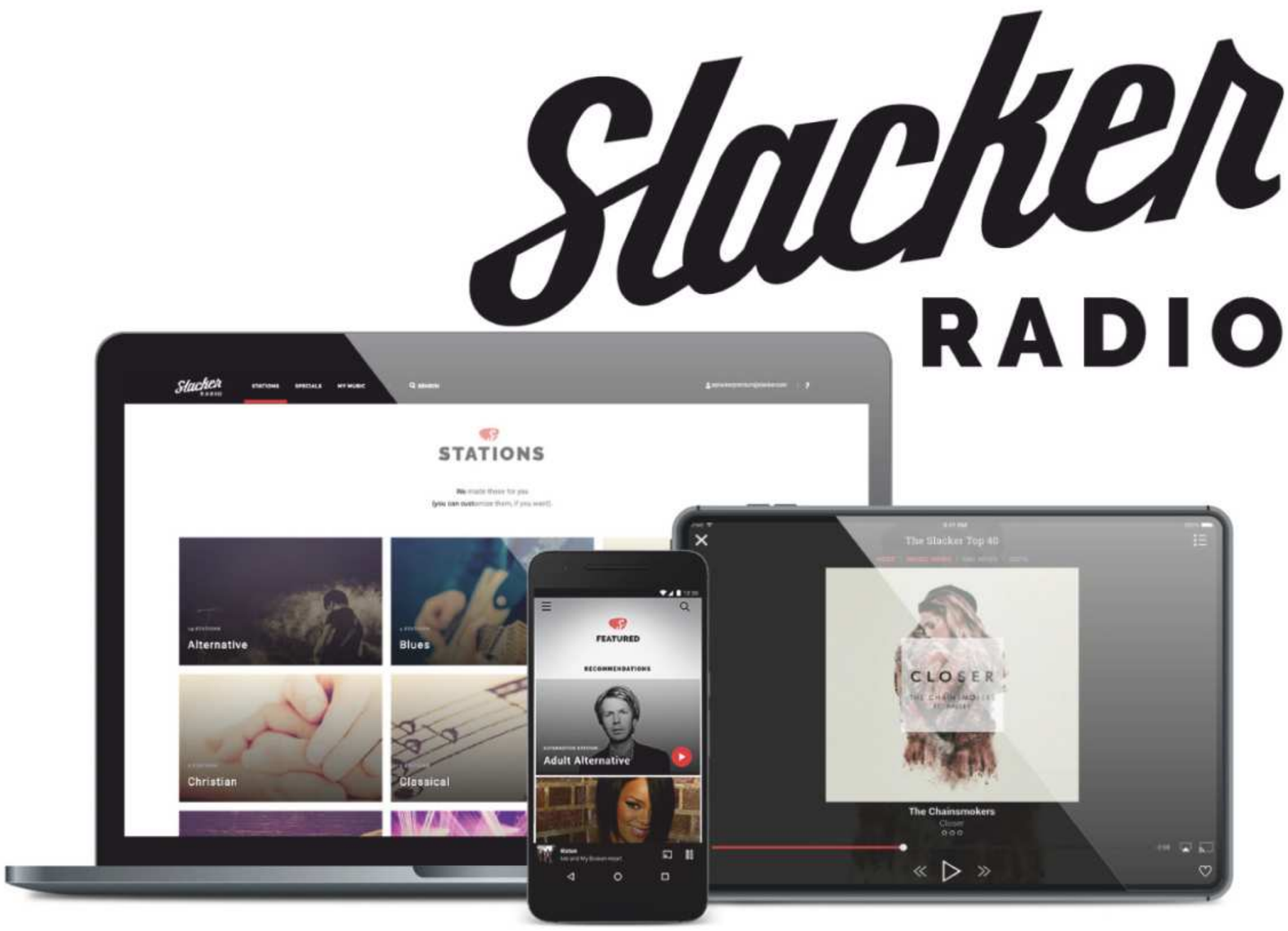
Microsoft claims 13.5 hours of battery life for the Surface Pro 6, and it bettered that by about an hour on our rundown test, lasting for 14 hours and 38 minutes. This runtime was the best of the batch, beating the ThinkPad X1 Tablet (8:49), the Surface Pro with LTE (13:15), the Ideapad Miix 520 (7:32), and the Dell Latitude (10:36). Long battery life is a great fit for this type of machine; you'll feel comfortable taking it on the road or away from your desk for long stretches.

DETACHABLE DOMINATION: STILL IN EFFECT

The Surface Pro 6 is moderately faster than the last generation, and the black color option is a plus, but those are the only changes of note. These modest alterations mean you won't likely need to upgrade if you have a recent Surface Pro model. But if you're coming from an early-gen Surface, a different 2-in-1, or the ground floor, this new-kid 2-in-1 is worth considering.

The extra cost for the keyboard is still disappointing, but it does work as well as ever (and has the same in-lap issues as the past). With few changes to a tried-and-true formula, one that has helped Microsoft reach the upper echelon of hardware sellers, the Surface Pro line is likely to continue to make new converts. It doesn't take the Editors' Choice away from the more business-minded ThinkPad X1 Tablet since it hasn't made any significant changes, but these two 2-in-1s are the top two to consider in this category.

MATTHEW BUZZI



Slacker Radio: A Top-Notch Streaming Service

PC MAGAZINE EDITORS' CHOICE

Slacker Radio, one of PCMag's favorite streaming music services, may have begun as the human-curated alternative to the pioneering, Music Genome Project-powered Pandora Internet Radio, but it's evolved into so much more. The service has expanded to include news and weather updates, excellent music-festival coverage, and well-conceived themed stations hosted by incredibly knowledgeable DJs. Unfortunately, Slacker Radio still lacks a family plan—but apart from that, it's a top-notch, well-rounded service that showcases what a streaming music platform should be.

Slacker Radio

Free, $3.99 per month, or $9.99 per month

START ME UP

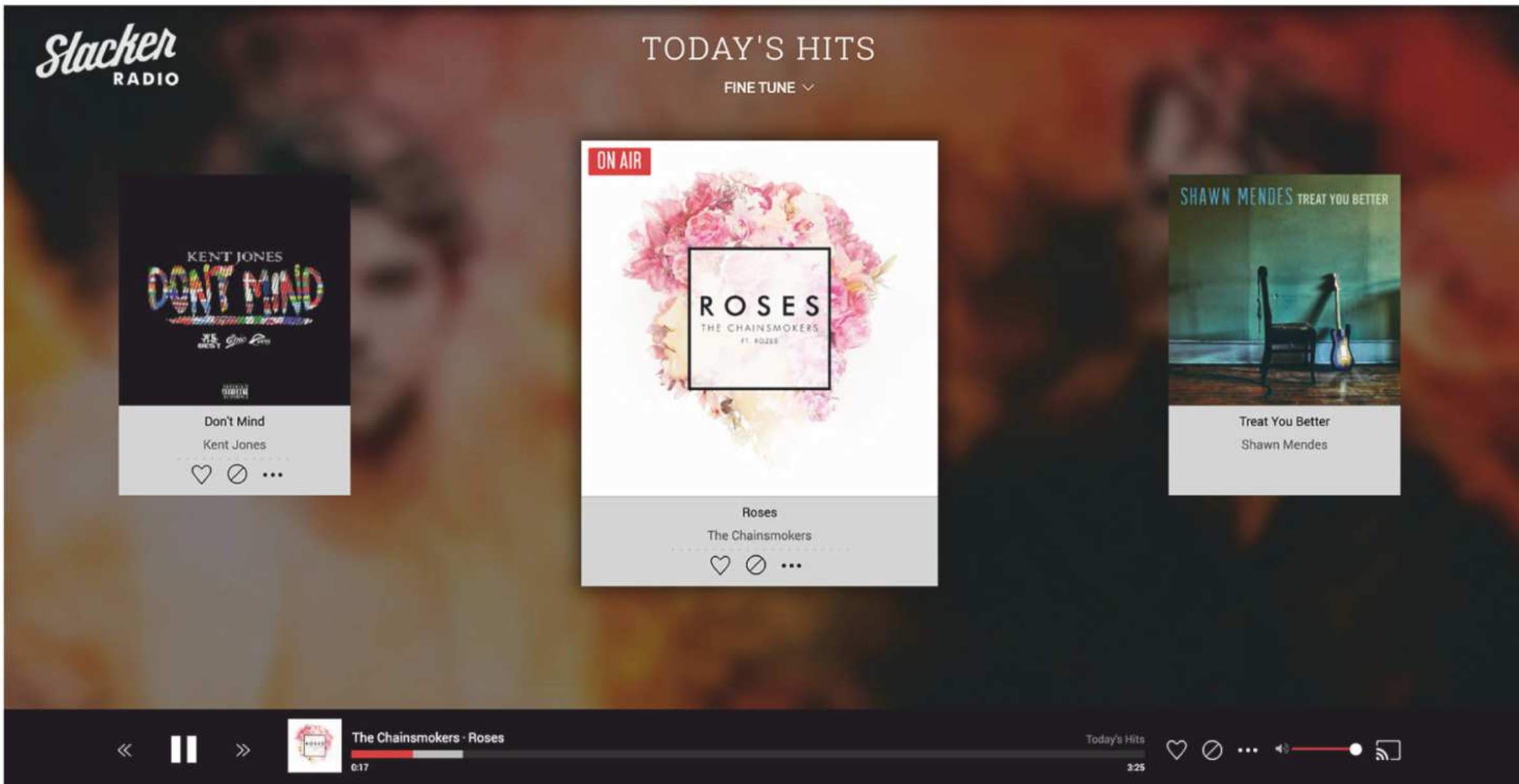
Slacker Radio offers three listening plans for music fans. With Slacker Radio's Free plan, you get 128Kbps audio, and the ability to skip a maximum of six songs per hour. In exchange, you have to endure plenty of audio and banner advertisements. Subscribing to Radio Plus ($3.99 per month) removes the ads and skip limitations, ups the bit rate to 320Kbps, and lets you cache stations for offline listening. Slacker Premium ($9.99 per month, tested for this review) builds upon the Plus tier by letting you create custom playlists, cache albums and playlists for offline listening, and play songs and albums on demand.

On-demand playback is easily the best reason to upgrade to a Plus or Premium account, as you'll no longer have to wait for Slacker Radio to serve up the tracks you most want to hear. I simply keyed song titles into the search box and listened to my favorite tunes. Some songs, however, aren't available on demand because of licensing issues. Another gripe: you can't record music, as you can with SiriusXM Internet Radio, the Editors' Choice for streaming services focused on the live radio experience.

Slacker Radio

PROS Excellently curated stations and fun playlists. Intuitive design. Informative DJs. News and The Weather Channel updates.

CONS No family plan. Lacks lyrics.



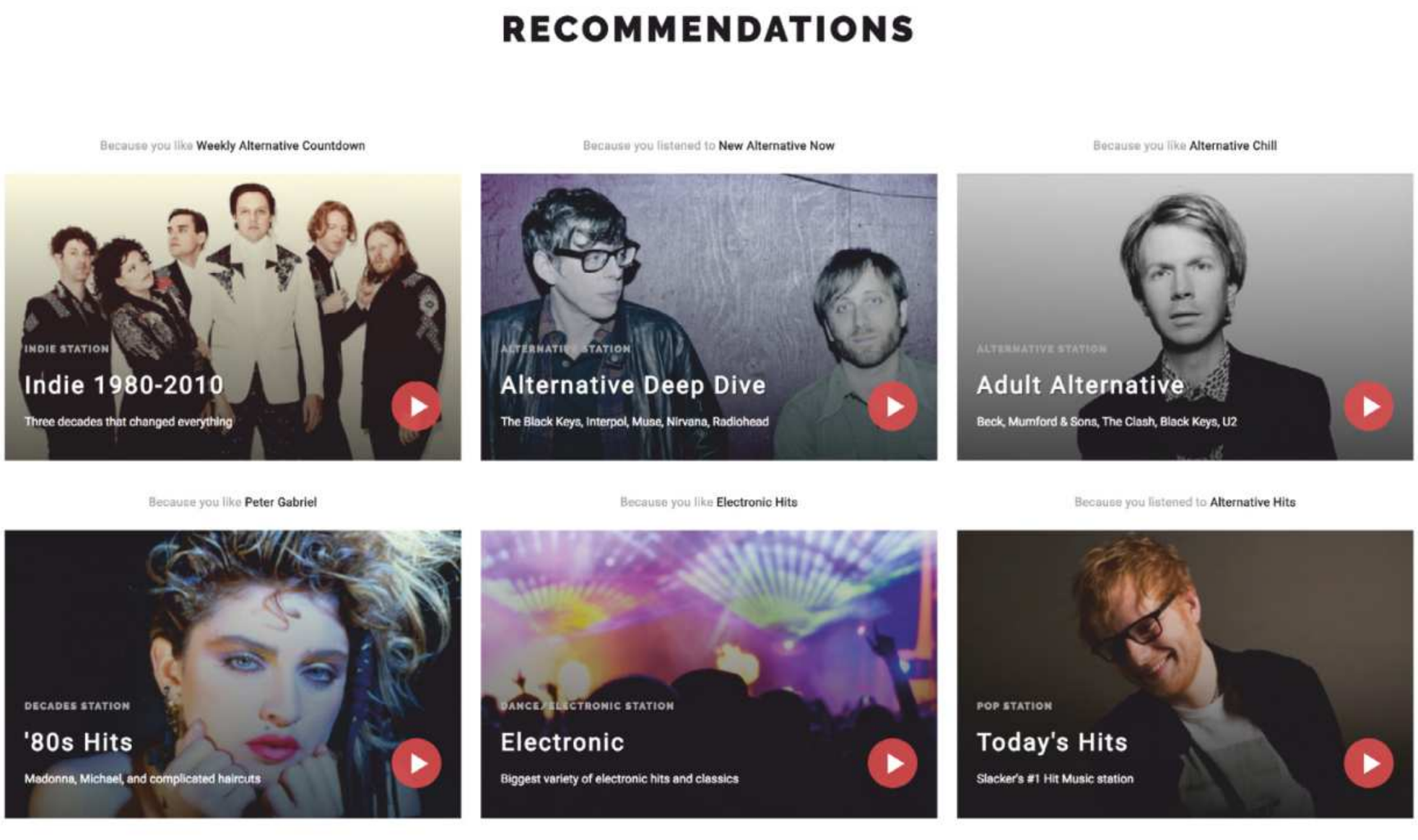
As mentioned earlier, Slacker Radio lacks a family plan, an attractive feature for multi-user households. Amazon Music Unlimited, Apple Music, Deezer, Spotify, Tidal, and YouTube Music one-up Slacker Radio in this regard. It's one of my few complaints about Slacker.

YOU GOT THE LOOK

Like YouTube Music, Slacker Radio has a panel-driven interface that's more than just eye candy, as it places a lot of information on the home page. Across the top is Recently Played, a section that lets you quickly return to one of the last four channels you've visited. Just south of that is Today on Slacker, the main content area. There you'll find the latest Slacker Radio DJ picks, as well as recommendations based on tracks you've previously favorited or banned the service from playing again. It's a great way to discover music without firing up a song or digging through music categories.

“Slacker Radio has a panel-driven interface that's more than just eye candy, as it places a lot of information on the home page.”

For example, Red Hot Chili Peppers is a Recommended Artist for me because I've favorited Nirvana songs in the past. Other panels that have caught my eye include '70s Rock, 35 Biggest Jerks In Music History, and Spotlight: Modern Jazz, all of which inspired me to click through to the corresponding stations.



I particularly enjoy the channels that link the past with the present. The Artist DNA stations, for example, are channels hosted by music experts who play the tracks that influenced important artists. And Sample City highlights the musical snippets that have built popular contemporary songs. Each is a music history class that competing services, such as Spotify and iHeartRadio, lack.

MAGICAL SOUND SHOWER

One way to begin your Slacker musical journey is by clicking a panel or scrolling to the top of the page, where you'll find a search box, Stations, and My Music. Stations has featured content, such as The 55 Nuttiest Artists; genre channels that include Comedy, Hip Hop Hits, and Big Band; and recommendations, such as Great Songs You Forgot. My Music is where you find your playlists, custom stations, and recently played stations. Slacker Radio has dozens upon dozens of stations, so you're sure to find one of interest.

Slacker Radio has a deep catalog. It boasts Taylor Swift's *Reputation* album as well as songs by other popular artists that were previously unavailable. If, for example, you're in the mood for killer guitar riffs from The Purple One, please note that Slacker Radio once again has Prince's library. It was a Tidal exclusive for a while but reappeared on Slacker after the artist's death.

In addition to its robust music collection, Slacker Radio carries ABC News, though it no longer has live ESPN Radio. Another cool feature is Slacker Stories, which delivers "Bill Murray Stories," "Star Wars Stories," and other pop culture tales.

As with SiriusXM Internet Radio's MySXM feature, Slacker Radio has sliders to tweak playback metrics in the Related Artists, Favorite Songs, Popular Songs, and New/Older song categories. Unlike SiriusXM's MySXM, Slacker's sliders remain the same from station to station. Still, the additional customization options open the door to more tightly crafted personalized stations.

As is common with these sorts of services, clicking the ban icon prevents a song or artist from appearing. Clicking the heart-shaped favorite icon causes Slacker to play it more frequently. You can also turn Slacker's music, sports, and news updates on and off.

Slacker Radio streamed crisp, hiccup-free audio at 128Kbps and 320Kbps (for the Free and Premium plans, respectively) in testing over both my home and office network connections. Unless you're a serious audiophile, Slacker Radio's sound quality will satisfy even when the audio is pumped through desktop speakers. That said, if you demand nothing less than the best audio quality, Tidal is the service for you. Its HiFi plan ($19.99 per month) streams delicious, uncompressed 1,411Kbps FLAC audio.

“Slacker Radio's sound quality will satisfy even when the audio is pumped through desktop speakers.”

BABY, I'M A STAR

Slacker Radio's quality streaming audio, on-demand access, news, and deep customization options make it a co-Editors' Choice (along with Spotify) among premium streaming audio services. A few minor complaints aside, Slacker Radio is a complete package, one that continues to dominate the streaming music landscape.

JEFFREY L. WILSON

Mega Man 11 (for PC): Fantastic Retro Side-Scroller

PC MAGAZINE EDITORS' CHOICE

Mega Man 11 is a continuation of Capcom's iconic side-scrolling platformer franchise, and it retains many of the series' classic elements. In terms of gameplay, Mega Man 11 introduces the impressive speed- and power-boosting Double Gear system, which offers new ways to avoid obstacles or dispatch enemies. There are a handful of hazards strewn throughout this action game that feel a touch unfair, and some stages drag on for much too long. Nonetheless, Mega Man 11 delivers a wonderfully fun challenge that's splashed with a fresh coat of paint.

Mega Man 11 (for PC)

$29.99

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THE BLUE BOMBER

The mainline Mega Man games are side-scrolling platforming titles with a strong focus on action. You run through eight themed stages as Mega Man, a robot boy with a penchant for jumping and blasting robotic enemies with his potent Mega Buster arm cannon. Stages are littered with death pits, murderous spikes, and dozens of obnoxious foes who do their best to rush you, shoot you, or simply get in your way.

Each stage culminates in a boss fight, which bombards you with attacks and tests your ability to recognize patterns and telegraphs. Upon a boss's defeat, you earn a new weapon that you can use in other stages. The new weapons counter specific bosses much more effectively than your standard Mega Buster. That's the old; now, let's explore the new.

DOUBLE TROUBLE

Mega Man 11 does not deviate much from the classic formula, but Capcom introduced the Double Gear boost system to freshen the experience. This new feature consists of Power Gear (a boost that improves your damage output for a few seconds) and Speed Gear (a boost that momentarily increases your speed). These abilities mitigate some of the game's difficulty; Speed Gear, in particular, makes it easier to evade obstacles or projectiles and line up jumps.

Mega Man 11 (for PC)

PROS Fun new mechanics. Tight platforming action. Rewarding challenge. Great 2.5D visuals that capture the series' art style and sprite-based origins.

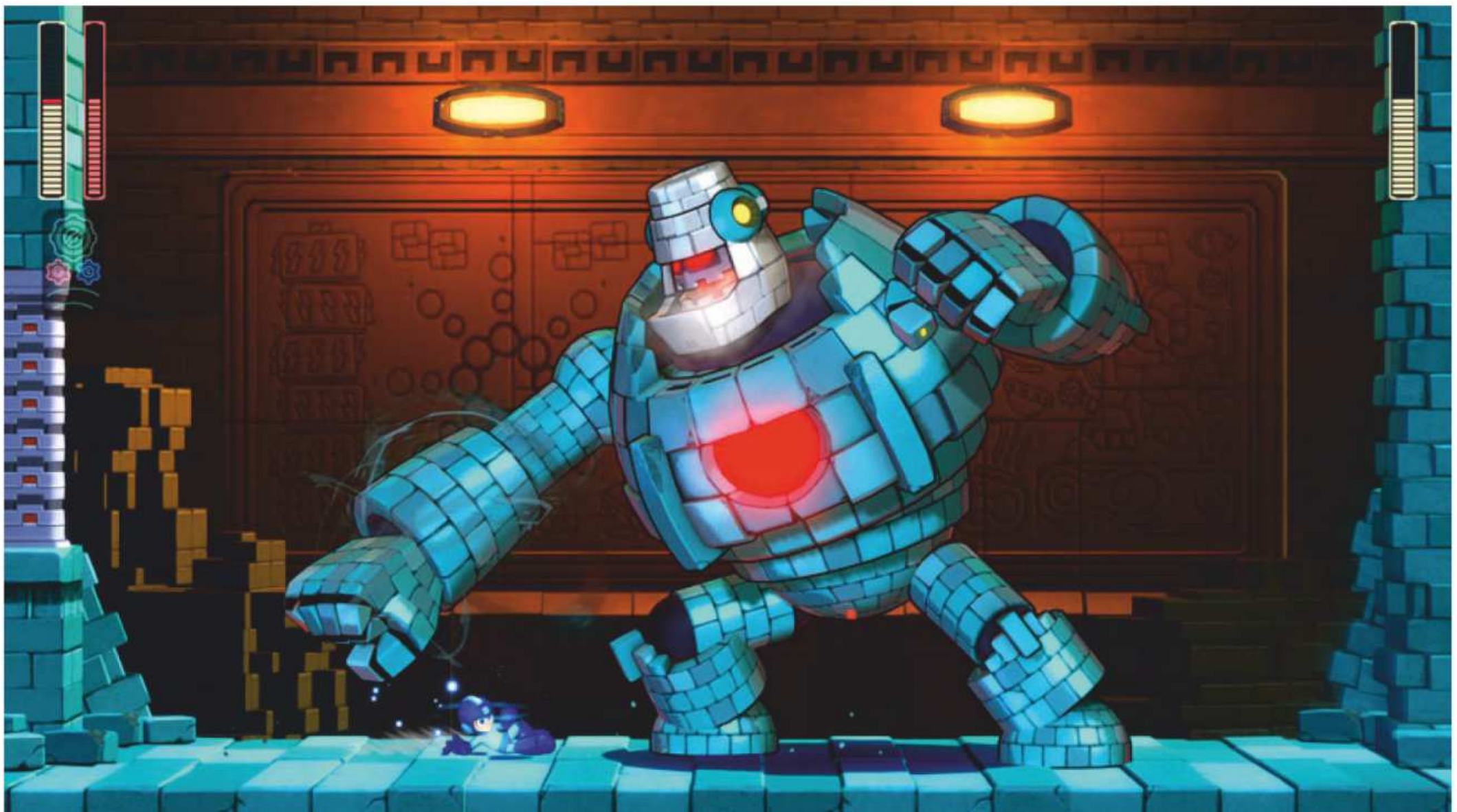
CONS Some stages overuse hazards and can feel unfair. Long stages with not enough checkpoints.

The Power Gear gives Mega Man a massive damage boost and is especially useful during boss fights. Your Power Gear-enhanced shots become huge, highly damaging missiles that make short work of virtually anything in the game when used effectively.

That said, the Gear enhancements are not end-all abilities; good timing is required to get the most mileage from them. When a boost is activated, you have about 4 seconds to use it before the gear overheats and prevents you from using it again for a brief amount of time. Players must deliberately activate and deactivate boosts to maximize their usage without entering the overheat penalty, which makes for some very dynamic gameplay. Upon replaying the game, I found myself constantly cycling between Gears to get through trickier platform sections or obnoxious enemies, and the system ultimately became second nature to use.

SCHOOL OF HARD KNOCKS

Mega Man 11 is a challenging game, despite the potential offered by the Double Gear system. The game's stages are surprisingly long, and checkpoints are few and far between. With such long, hazard-filled stages, you're more likely to make mistakes and die from enemy damage, missed jumps, or simple carelessness. Dying drops you back at the nearest checkpoint. Running out of lives boots you out of the stage and back onto the stage-select screen, which forces you to retry the level from the very beginning. Mega Man 11 is decidedly retro in this regard, and the game doesn't hold your hand when it comes to lives and retries.



Not all stages drag on, mind you. I found Fuse Man's stage, for example, to be extremely easy and straightforward, and I plowed through it on a single life. Acid Man's stage, on the other hand, chewed through eight of my lives before I could beat it, due to a combination of strategically placed spikes and accumulated damage.

In general, Mega Man games introduce you to stage hazards and gimmicks in a safe area before testing your reflexes and understanding in subsequent rooms. This is still the case in Mega Man 11, but some zones occasionally push your reaction abilities too hard. For example, Impact Man's stage bombards you with hazards and projectiles, forcing you to think fast and avoid crap spewed at you from various angles, rather than teaching you about a unique gimmick and expecting you to master it. Acid Man's stage makes excessive use of spikes and awkward water mobility, and some stage transitions drop you directly onto spikes if you don't maneuver Mega Man out of the way.

Worse still, enemies respawn when you walk a certain distance from their original location, so if you happen to be in a large room with several shooting enemies, you can very easily get hit by one that you dispatched earlier if you move back too far.

This is not commonplace, mind you, and most stages keep things pretty fair. Blast Man's stage, for example, starts you off in a screen with a single, fire-spewing robot perched on a platform. The robot doesn't attack unless you move into its proximity, but when it does, the robot ignites the red blocks you are standing on, causing them to explode and damage you. Once the robot's destroyed, the fuel tank on its back blasts towards you, exploding when it collides with anything and igniting the floor should the blast come into contact

with it. You learn several crucial combat elements about the stage from this single screen, so when the game starts throwing more explosive floors and fire-spewing robots at you, you feel prepared and understand what to expect. Most stages follow this helpful formula.

Overall, Mega Man 11 never curveballs you so hard as to feel offensive; every threat you encounter can be overcome with Mega Man's basic moves and the Double Gear system. But death is a devastating setback, especially if you lose your lives close to the finish line. It takes a certain amount of discipline to not rage should this inevitably happen, but at the same time, I appreciate Mega Man's attitude towards challenges.

UPGRADES AND OPTIONS

Rather than hold your hand, Mega Man 11 lets you buy upgrades or power-ups to make your run through stages easier. You can use currency collected from defeated enemies or hidden throughout stages to buy more lives or extra energy tanks for mid-level healing. Additional perks let you power up shots more easily or let you cool down your gears more quickly. They make you feel like you're developing Mega Man as you progress through the game.

Mega Man 11 offers a handful of optional game modes to enjoy beyond the standard stage select, such as Time Attack, which has you race through stages for the best time, and Balloon Mode, which has you shoot down balloons in enemy-free-levels for points. None of the optional modes deviates significantly from the established formula, but they are neat distractions.

Mega Man 11 makes good use of cel-shaded visuals and simple 3D character models, which give the game a great two-dimensional look. The 2.5D aesthetic is very faithful to the series' anime-style art and sprite-based roots. These visuals are hardly taxing, so the game runs perfectly well on my Nvidia GeForce GTX 970–powered rig. I saw a steady 60 frames per second.

According to Mega Man 11's Steam page, your gaming PC must match these minimum specs: a 3.2GHz Intel Core i5-3470 CPU, Nvidia GeForce GTX 650 GPU, 4GB of RAM, and the 64-bit version of Windows 7, 8.1, or 10.

Mega Man 11 supports Steam Cloud, Steam Trading Cards, Steam Leaderboards, and 50 Steam Achievements. Capcom wraps the game in Denuvo Anti-tamper, third-party anti-bootlegging software.

Rather than hold your hand, Mega Man 11 lets you buy upgrades or power-ups to make your run through stages easier.

TRIUMPHANT RETURN

Mega Man 11 is a short game, but it's packed with classic side-scrolling gameplay that will appeal to fans and new players alike. The visuals, while simple at first glance, are full of wonderful details. The controls are tight and snappy, and the Double Gear system is fun to use and well incorporated into the game's challenge. If you're looking for an old-school game to spend some time with, look no further than Mega Man 11.

GABRIEL ZAMORA

FEATURES

THE BEST TECH PRODUCTS OF 2018

BY PCMAG STAFF

From PCs, peripherals, and smart home tech to apps, games, and beyond, in 16 top categories, these are teh very best products we've tested all year. It's the ultimate holiday gift guide for the most deserving tech lovers on your list.

Narrowing down the best of the best is a daunting task. To scale to the peak of product perfection, reviewers and analysts in PC Labs slog through hundreds and hundreds of lesser devices, services, and apps every year, and that's just to get to the base camp. Only then can they get a clear view of the pinnacle, and even then a few high-quality stalwarts could likely vie for the top. Then it's a case of narrowing down a true winner.

That's what we do every year by forcing the staff at PCMag to pick the best tech products. Typically, we limit the list to 100 products, but this year, we notched the total up to 107. Keep in mind that's only 107 out of around 2,500. We crank out a lot of reviews.

If you compare this year's list to the best of 2017, you'll see that a lot of vendors are very consistent in product quality year-to-year. Razer makes great gaming laptops; Apple's iPhones and Apple Watch are always a top pick; the Microsoft Surface line consistently earns accolades. There are also surprises: Google is making the best Android phone now, as well as the best digital assistant; Sony swept almost all the camera categories; and many of the best security products today are different than last year (so it might be time to upgrade).

Across the 16 categories below, you'll find the absolute best of everything we've reviewed from November 1, 2017 to today. Eighty-seven of the products earned our coveted Editors' Choice Award, and adding a Best of the Year designation makes them even more impressive. Six products earned an "outstanding" 5-star rating; the remainder are merely "excellent," with almost all earning 4- and 4.5-star ratings.

Consider this your ultimate holiday gift list. With our wholehearted endorsement of every item in this story, you can't go wrong.

1 ULTRAPORTABLE
DELL XPS 13 (9370)
$2,049.99 (AS TESTED) EDITORS' CHOICE ●●●●◐

A new rose-gold-and-white color scheme makes the venerable Dell XPS 13 a stunning fashion statement, and it's backed by strong performance and a svelte but sturdy build. Thunderbolt 3 connectivity and the option for a 4K screen allow for maximum flexibility for mobile power users in our favorite ultraportable.

2 DESKTOP REPLACEMENT
APPLE MACBOOK PRO 15-INCH (2018)
$4,699 (AS TESTED) EDITORS' CHOICE ●●●●◐

With the option for an Intel Core i9 processor (which we saw in our test unit), the sleek 15-inch MacBook Pro is now one of the most powerful desktop-replacement laptops you can buy, making it an excellent choice for well-heeled, on-the-go creative pros. The beautiful, super-high-res panel now supports automatic color-temperature adjustment. New options for cavernous SSD capacities will please buyers who need to render and edit big media files on the go.

3 BUDGET LAPTOP
ACER SPIN 1 (SP111-32N-C2X3)
$329.99 (AS TESTED) EDITORS' CHOICE ●●●●○

With its wealth of features and aggressive pricing, the 11.6-inch Spin 1 is an excellent-value swiveling-screen 2-in-1 convertible. We were surprised by what you get for the money: a great 1080p touch display, long battery life, and handsome fit and finish, as well as a very usable keyboard and touchpad.

4 CHROMEBOOK
HP CHROMEBOOK X2
$599.99 (AS TESTED) EDITORS' CHOICE ●●●●○

With an elegant detachable design and a spiffy screen, HP's pioneering Chromebook x2 detachable is firmly cemented in the elite of the Chrome OS field. The hinge design is more lap-friendly than the typical tablet with a kickstand, and our tests uncovered both strong performance and battery life.

5 BUSINESS LAPTOP
LENOVO THINKPAD X1 CARBON (2018)
$1,789 (AS TESTED) EDITORS' CHOICE ●●●●○

The ThinkPad X1 Carbon offers premium features in a slim, attractive package that business users will love—just be prepared to open your wallet wide for this top-notch ultraportable laptop. This perennially refined flagship machine hits new highs in its 2018 reboot: It doesn't skimp on either its thin-and-light aspect or its battery life. (And recharges are quick.)

6 MOBILE WORKSTATION
DELL PRECISION 5530
$3,647 (AS TESTED) EDITORS' CHOICE ●●●●○

If Dell's XPS 15 went to engineering school, it would graduate as the Precision 5530, a light, thin 15.6-inch mobile workstation. The Dell Precision 5530 copies that iconic laptop's excellent design to create a lightweight basher with options for an overpowering six-core Xeon CPU, Nvidia Quadro graphics acceleration, and a spiffy 4K touch panel.

7 GAMING LAPTOP
RAZER BLADE (2018)
$1,329.00 AS TESTED EDITORS' CHOICE ●●●●○

The 2018 revision of the Razer Blade redefines the category it inspired: the super-slim, powerful gaming laptop. The best thin design in the business now packs a roomier 15.6-inch display and cutting-edge components—not to mention best-in-class overall performance and surprisingly good battery life. Per-key RGB backlighting doles out a measure of gamer attitude, as well.

8 CONVERTIBLE-HYBRID LAPTOP
LENOVO YOGA C930
$1,299 (AS TESTED) EDITORS' CHOICE ●●●●◐

With a wholly revamped hinge, a stylus that now has a place to park, and a sleek design, the Lenovo Yoga C930 is the best device for people who need a premium laptop but want the flexibility to use it as a tablet now and then. A stylish metal chassis with multiple color options, the option for a 4K HDR display, and excellent battery life place the C930 among the most envy-worthy 2-in-1s ever made.

TABLETS & EBOOK READERS

9 HIGH-END TABLET
MICROSOFT SURFACE PRO 6
$1,199 (AS TESTED) ●●●●○

Given its modest speed boost and status-quo connectivity loadout, the Surface Pro 6 may not have changed much from the previous iteration. But what we loved about this 2-in-1 convertible then, we still love now. The revitalized pep comes courtesy of new 8th Generation Intel processors, the battery life is solid, and Microsoft now offers its veteran detachable in a sleek, all-black color scheme.

10 MIDRANGE TABLET
APPLE IPAD (2018)
$329 EDITORS' CHOICE ●●●●○

No tablet delivers value like the amazing $329 iPad. Fast, secure, and easy to use, the new iPad is a reliable media and educational companion for kids or a creative tool for adults. It's compatible with Apple's Pencil stylus and has a tremendous range of third-party cases and keyboards available. The tablet's speed and deep bench of excellent iOS applications have pretty much stamped out midrange Android tablets as a category, and it's much faster and smoother than a Windows product at this low price. This is where iOS really shines.

11 UNDER-$100 TABLET
AMAZON FIRE HD 8 (2018)
$79.99 EDITORS' CHOICE ●●●●○

Amazon continues to deliver the only really reliable tablets in the US under $100. This cheap price range is a chaotic jungle of questionable quality until you see the Fire HD 8 rise in the distance: decently built, with an elegant UI, just enough RAM and storage, and real customer support from a company you've heard of. For a basic media tablet, especially to keep the kids busy in the car, the Fire HD 8 is by far the best choice.

12 EBOOK READER
AMAZON KINDLE PAPERWHITE (2018)

$129.99 **EDITORS' CHOICE** ●●●●◐

Amazon's 2018 Paperwhite brings bathtub reading to its lowest price ever. At $129.99, it's $50 less than the next-least-expensive waterproof e-reader. It does audiobooks, too, and its new flat-front design is better for beach reading than previous models were. (It has no nooks and crannies around the screen for sand to get caught in.) Families who use Kindles together will enjoy the new ability to save font settings, easily flipping between regular and large-type reading. E-readers should be all about simplicity and lack of worry, and the 2018 Paperwhite is a no-stress, no-worry experience.

13 CELLULAR NETWORK
VERIZON WIRELESS

Every year, we think someone will dethrone Verizon; every year, no one does. Verizon maintained its win in our Fastest Mobile Networks awards this year using its reliable plan: turning on all of the latest network technologies, including four-carrier aggregation and LAA, but not making a big deal or a fuss about it. The company's excellent spectrum portfolio and network-first culture continue to pay off and put Verizon in a strong position as 5G launches in 2019.

14 ANDROID PHONE
GOOGLE PIXEL 3

$799.00 **EDITORS' CHOICE** ●●●●◐

Google's new Pixel is the apotheosis of Android in 2018. It's not just about being "stock Android" any more; it's what Google manages to add to the mix, with guaranteed updates to the next version of Android, the best camera of any phone today, and innovative robo-secretary features that let you get back at all those robo-callers. The Pixel is also the smallest flagship phone on the market, making it clear that great power can indeed still come in a package you can hold in one hand.

15 IOS PHONE
APPLE IPHONE XS MAX
$1,099.00 **EDITORS' CHOICE** ●●●●◐

It's excessive. It's the maximum. The iPhone XS Max is the most iPhone you can get: the most cameras, the best screen, the most memory, and the best radio performance. While the same size as the popular iPhone Plus line, it has a much larger screen thanks to much smaller bezels. Now that people are paying for phones on three-year contracts, you want a phone that will go the distance. We're confident that the XS Max will take anything that the world can throw at it through 2021.

16 ADD-ON BATTERY
XIAOMI MI POWER BANK PRO
$29.99 **EDITORS' CHOICE** ●●●●◐

The best battery is one that's light enough that you forget you have it with you but that never seems to run out of power. Xiaomi's Mi Power Bank Pro succeeds on both counts. For only $30, you get a slim, attractive, and pocketable battery that holds more than three full charges for most phones and supports both fast charging and passthrough charging, in which you're charging both the battery and your phone. It's a reliable companion for anyone who tends to run out of juice halfway through the day.

17 SMARTWATCH
APPLE WATCH SERIES 4
$399.00 **EDITORS' CHOICE** ●●●●○

There's no longer any question: The Apple Watch Series 4 is the smartwatch to beat. The latest iteration of Apple's popular wearable has a larger display, better cellular connectivity, and more-advanced heart-rate monitoring than previous models. It even gives dedicated fitness trackers a run for their money, thanks to advanced health metrics and forthcoming ECG readings.

DIGITAL HEALTH & FITNESS

18 FITNESS TRACKER
FITBIT CHARGE 3
$149.99 EDITORS' CHOICE

The latest Fitbit Charge is just as appealing as its predecessors. The Charge 3 gets a handful of upgrades including a swim-friendly design, an improved heart rate sensor, an SpO2 oxygen saturation sensor, and longer battery life. All that in a package that's slimmer and much less expensive than a smartwatch.

19 HEART RATE MONITOR
POLAR OH1
$79.95

If you want a dedicated heart-rate monitor, the Polar OH1 is one of the best options. It's an armband monitor that uses an optical sensor, so it's smaller and less cumbersome than a chest-band monitor. It has onboard memory so you can track your workouts without carrying a phone with you and sync it later with your fitness app.

20 SMART SCALE
EUFY BODYSENSE SMART SCALE
$39.99 EDITORS' CHOICE

The Eufy BodySense Smart Scale is an inexpensive connected bathroom scale that can measure and track weight, BMI, and body composition for up to 16 different users. It's isn't fancy, but it's functional, flexible, and very affordable.

21 VOICE ASSISTANT PLATFORM
GOOGLE ASSISTANT
We had a split decision in our voice assistance categories this year. While Amazon has the best hardware, Google's voice platform has become the best choice for people who are relying on their assistant for the most popular uses: music, calling, weather, timers, recipes, and asking questions. Google Assistant is much better at handling arbitrary

requests than Amazon's Alexa, and its presence on every Android phone gives it a huge footprint that Alexa can't match. Unless you are heavily into having a smart home—where Alexa still reigns—Google Assistant has really come to the fore as the assistant most able to help you in your daily life.

22 SMART SPEAKER
AMAZON ECHO (2ND GEN)
$99.99 EDITORS' CHOICE

Although it was released in 2017, the Amazon Echo remains the best smart speaker for most people in 2018. It's an attractive little speaker that delivers solid sound quality. It's also the perfect gateway to using Amazon's Alexa voice assistant, which will tell you the time, how to cook a perfect leg of lamb, and even control your smart home devices, all without you having to get off the couch.

23 SECURITY SYSTEM
SIMPLISAFE HOME SECURITY SYSTEM
$229.96 EDITORS' CHOICE

If you want to put together your own home-security system without a contract or service provider, SimpliSafe offers everything you need. It's a DIY security system that provides a wide variety of devices, including locks, door and window sensors, water and freeze sensors, smoke and carbon monoxide detectors, and (of course) cameras.

24 SECURITY CAMERA
WYZE CAM PAN
$29.99 EDITORS' CHOICE

The Wyze Cam Pan offers all the features of earlier Wyze Cam models, such as motion and sound detection, time-lapse recording, and free cloud storage, and it adds mechanical pan and tilt and support for IFTTT applets. That easily makes it the best home security camera you can buy for the price.

25 DOOR LOCK
NEST X YALE LOCK WITH NEST CONNECT
$279.99

Nest and Yale work together to offer some stylish security in the Nest X Yale Lock. The touchpad looks downright fashionable with its black-glass screen and selection of metal bodies, and it works with Nest Connect to tie it together with your Nest security cameras.

26 VIDEO DOORBELL
SKYBELL HD
$199.00 EDITORS' CHOICE

For a video doorbell, the Skybell HD is loaded with features. It has 1080p video with color night

vision and pre-buffers video to capture events triggered by motion detection, and it comes with free cloud storage. It's also Alexa compatible, so you can bring a live feed of the doorbell up on your Echo Show or Fire TV device.

27 LIGHTING
EUFY LUMOS SMART BULB WHITE AND COLOR

$34.99 EDITORS' CHOICE ●●●●○

Eufy's Lumos smart bulbs don't need a hub to work. Simply screw them in and use the app to connect them to your Wi-Fi network. The Smart Bulb White and Color can change color and display a variety of whites, and it works with both Amazon Alexa and Google Assistant. It's a fun, accessible entry point in building a smart home.

28 ROBOT VACUUM
IROBOT ROOMBA I7+

$949.99 EDITORS' CHOICE ●●●●○

Robot vacuums get smarter with each generation, and iRobot's Roomba i7+ might just be the most advanced model we've tested to date. In addition to Amazon Alexa and Google Assistant voice control, multi-story mapping, and adaptive camera-based navigation that cleans better as it learns your home's layout, it's the only vacuum we've tested that can empty its own dustbin. Sure, at $949.99, it's one of the most expensive models we've seen, but it's also the only robot vacuum out there that doesn't require you to lift a finger. Isn't that why you want one in the first place?

“it's one of the most expensive models we've seen, but it's also the only robot vacuum that doesn't require you to lift a finger.”

29 SMART DISPLAY
AMAZON ECHO SHOW (2ND GEN, 2018)

$229.99 EDITORS' CHOICE ●●●●○

The new Echo Show fixes every complaint we had with Amazon's original smart display. The screen is bigger, the speakers are louder, and the design is much more attractive. It also has a fully functional web browser and greatly expanded entertainment options. It's the best smart display, regardless of voice assistant.

30 BUDGET TV
TCL 55R617
$649.99 EDITORS' CHOICE ●●●●○

You don't need to spend a lot of money for an excellent TV. TCL's 6-series TVs are 4K and HDR-capable with both HDR10 and Dolby Vision support, and they offer remarkably strong contrast and wide, accurate colors out of the box. They also come loaded with plenty of apps and streaming services, thanks to the Roku TV platform.

31 HIGH-END TV
LG OLED55E8PUA
$3,299.99 EDITORS' CHOICE ●●●●◐

Organic light-emitting diodes (OLEDs) remain the best technology for TVs, and LG remains the biggest name in OLED TVs. The OLEDE8PUA series is LG's "midrange" OLED, which is still pretty pricey compared with high-end LCD TVs. You get perfect black levels for incredible contrast and wide and accurate colors for the price, in a remarkably slim and sleek frame.

32 MEDIA HUB
AMAZON FIRE TV STICK 4K
$49.99 EDITORS' CHOICE ●●●●◐

Amazon's Fire TV devices keep getting better and more affordable. The Fire TV Stick 4K replaces the standard Fire TV, adding Dolby Vision support on top of HDR10 to its 4K streaming capabilities, all in a smaller and faster package that ducks under the $50 mark. It also has Alexa via its new TV-controlling voice remote.

33 SOUNDBAR
SONOS BEAM
$399.00 EDITORS' CHOICE ●●●●○

The Sonos Beam takes the powerful multi-room audio platform Sonos is known for and stuffs it into a remarkably svelte, stylish soundbar, and adds hands-free Alexa to boot. Use the Beam

just like an Amazon Echo to get information, play music, and control your smart home devices. It offers remarkably balanced, room-filling sound for whatever you want to watch.

34 MULTI-ROOM AUDIO
JBL LINK 300
$249.95 ●●●●○

The JBL Link 300 isn't the most fashionable speaker, but its modest price tag and powerful sound make up for that. It's a Google Assistant smart speaker, which means you can talk to it just like you would to a Google Home and cast to it from any device, thanks to the multi-room flexibility of Google Cast. It works just as though a Chromecast Audio is plugged into the back.

35 WIRELESS SPEAKERS
AUDIOENGINE A5+ WIRELESS
$499.99 EDITORS' CHOICE ●●●●◐

The Audioengine A5+ Wireless is a bookshelf- and desk-friendly set of Bluetooth-equipped speakers that offers audiophile-level sound quality with 24-bit upsampling when streaming wirelessly. They have plenty of power and clarity, and can work with a separate subwoofer.

36 BUDGET WIRELESS SPEAKER
ANKER SOUNDCORE FLARE
$59.99 EDITORS' CHOICE ●●●●◐

When it comes to Bluetooth speakers, $60 can go a surprisingly long way. The Anker Soundcore Flare features a waterproof design, a cloth grille, and colored LEDs. More important, it sounds very good for the price.

37 WIRE-FREE EARPHONES
JABRA ELITE ACTIVE 65T
$189.99 ●●●●○

Wire-free earphones have come far in only a few years, making strides in reliability, sound quality, and battery life since the Apple AirPods first came out. The Jabra Elite Active 65t are among the pricier wire-free earphones, but they provide a secure and reliable fit, workout-friendly waterproofing, powerful sound, and an adjustable five-band EQ.

38 EARPHONES
JAYBIRD X4
$129.99 EDITORS' CHOICE ●●●●○

Jaybird continues to impress us with its X series of wireless earphones. The Jaybird X4 earphones offer powerful sound and comfortable fit. They're waterproof, so you can take them to the gym. And you can adjust their EQ from balanced audio to overwhelming bass to power through your workouts.

39 HEADPHONES
SONY MDR-Z7
$698.00 EDITORS' CHOICE ●●●●◐

If you want professional-level sound for mixing and engineering, Sony's MDR-Z7 is the pair of headphones for you. They reach from 4Hz to 100kHz, with balanced and accurate response across the spectrum. They're a worthwhile investment if you plan to master tracks or simply want to hear them the same way an engineer does.

40 COMPACT CAMERA
SONY CYBER-SHOT DSC-RX100 VI
$1,199.99 EDITORS' CHOICE ●●●●○

Our favorite compact camera of 2018, the Sony Cyber-shot RX100 VI, falls squarely into the premium price category. After all, it costs more than many interchangeable-lens models. But

its 24-200mm zoom will cover most of your needs, and the 1-inch image sensor is much bigger than the imager in your smartphone, which makes for sharper, crisper images even when you're shooting in difficult light.

41 BRIDGE CAMERA

SONY CYBER-SHOT DSC-RX10 IV

$1,699.99 ●●●●○

The Sony Cyber-shot DSC-RX10 IV may be an overkill for many. It's a bridge-style camera, similar in shape to an SLR but with a permanently attached lens. But my, what a lens. It has a 24-600mm (full-frame equivalent) zoom range, and is bright with an f/2.4-4 variable aperture. The 1-inch image sensor delivers loads of detail in every 20MP photo, and Raw capture is available at 24fps with phase detection focus. Weather-sealing, 4K video, and a sharp EVF make the RX10 IV a first-rate option for travel and wildlife photography.

42 FULL FRAME CAMERA

SONY A7 III

$1,999.99 (BODY ONLY) EDITORS' CHOICE ●●●●●

The Sony a7 III is the best camera you can buy for around two grand. It's got a 24MP full-frame image sensor, an insane autofocus system with 10fps subject tracking, and excellent 4K video capabilities. It redefines what an entry-level full-frame camera can be, setting a high bar for others in the category to aspire to.

43 CROP SENSOR CAMERA

FUJIFILM X-E3

$899.95 (BODY ONLY) ●●●●○

Fujifilm had a good 2018. It released two premium models, the X-H1 and X-T3, both of which offer high-end features for capturing action and 4K video. But the lower-priced X-E3 delivers excellent images and autofocus, all in a slim form factor. It's a very pretty camera too, one that's likely to garner a few compliments.

44 LENS

TAMRON 28-75MM F/2.8 DI III RXD

$799.00 EDITORS' CHOICE ●●●●○

Sony's full-frame mirrorless system has been around for half a decade and has gained enough traction in the marketplace to attract the attention of third-party lens makers. Sigma has, to this point, simply converted SLR lenses to the mirrorless mount. Tamron took a different path, designing the 28-75mm f/2.8 Di III RXD from the ground up. It's the best affordable zoom for the system and our favorite lens of 2018.

45 360 CAMERA
GOPRO FUSION
$699.99 ●●●●○

The 360-degree video format may end up being a flash in the pan for consumers—remember 3D television? But what if you took the spherical video and turned it into something that you can watch on your phone or TV? The GoPro Fusion lets you do just that, with software that extracts a 16:9 frame from the raw 5.2K spherical video. You can pan with smooth motion control, zoom in to lock onto details, and pull way back to show the world as a Little Planet projection. And, because it's a GoPro, the Fusion is built tough, with a rugged, waterproof design.

“What if you took the spherical video and turned it into something that you can watch on your phone or TV?”

46 ACTION CAMERA
GOPRO HERO7 BLACK
$399.00 EDITORS' CHOICE ●●●●○

GoPro's marquee Hero line of action cameras has faced stiff competition from upstart competitors such as YI. But while others undercut GoPro on price, they can't match the Hero7 Black when it comes to features. The camera is rugged and waterproof, shoots 4K video at up to 60fps, and includes stabilization that is even better than what we saw on last year's Hero6 Black. Yes, it's more expensive than others, but its digital stabilization system is worth the cost of entry.

47 DRONE
DJI MAVIC AIR
$799.00 ●●●●○

If you're buying a drone, chances are it's from DJI. The company dominates the space. It's also not one to stand still, with a very aggressive approach to developing and releasing new models. The Mavic Air is the company's smallest folding drone, but it doesn't skimp on features. It delivers stable 4K video from the air, as well as 12MP photos and stitched panoramas. Flight is made safer via redundant systems, GPS positioning, and obstacle detection sensors. The Mavic Air even has a flight mode that maps obstacles and flies around them automatically—that's pretty cool.

48 ELECTRIC CAR

2019 JAGUAR I-PACE

$88,595.00 **EDITORS' CHOICE** ●●●●◐

With the 2019 I-Pace, Jaguar is the first major luxury automaker to introduce an all-electric car that combines high-performance driving with long EV range. (Technically, Tesla got there first, but it falls far short in terms of production and availability.) The I-Pace also sets itself apart by borrowing off-road tech from its Land Rover siblings, making it suitable for travel on and off pavement. But the biggest draw is its estimated 240 miles of range on a full charge, combined with seat-pinning performance.

49 CAR TECHNOLOGY

GARMIN SPEAK PLUS WITH AMAZON ALEXA

$199.99 ●●●●○

The Garmin Speak Plus is a dash cam, a GPS device, and an Alexa-based smart speaker all rolled into one. An update to the Garmin Speak GPS device, the Speak Plus adds dash-cam functionality. In addition to getting directions and recording the road ahead, you can use the Speak Plus to play tunes from your Amazon Music collection or ask Alexa to find a radio station. It can also control Alexa-enabled smart home devices such as lights or a thermostat. The tiny device does its job, as long as you don't need to see onscreen maps as you navigate.

50 BUDGET DESKTOP

DELL INSPIRON GAMING DESKTOP (5680)

$999.00 (AS TESTED) EDITORS' CHOICE ●●●●○

As we tested it, the configurable Dell Inspiron Gaming Desktop delivers 60-frame-per-second 1080p gaming and Core i7 pep at $999, making it an attractive bargain for gamers. The reason it wins for overall budget desktop, however? You can get many of the same winning rudiments of this PC starting at $599, among them Nvidia's dedicated "Pascal" GeForce GTX graphics cards; appealing, low-key case lighting; and full-fat Intel Core "Coffee Lake" desktop chips.

51 ALL-IN-ONE DESKTOP

HP ELITEONE 1000 ALL-IN-ONE

$1,519.00 AS TESTED EDITORS' CHOICE ●●●●○

The EliteOne 1000 is not only stylish, but it also has a trait found in few all-in-one PCs: You can easily upgrade the internal components, which live in a rectangular base section rather than behind the screen. The main focus for your eyes is a beautiful, trim, 27-inch 4K display, but you'll also note some clever details (such as dual front-and-back webcams that slide behind the display when not in use) as well as quiet-running internals. And the price was a pleasant surprise.

52 COMPACT DESKTOP

APPLE MAC MINI (2018)

$799 (AS TESTED) EDITORS' CHOICE ●●●●○

This update was worth the wait: Apple's iconic compact desktop delivers more core-processing, storage, and memory potential than ever, in a polished box brimming with cutting-edge connectivity. Memory is now implemented as SO-DIMMs, and the system is configurable with CPUs up to six cores and 12 threads. You can tick up the storage (2TB) and RAM (64GB) to new highs, and it's hard to best Apple's top-notch pre-installed software.

53 GAMING DESKTOP

CORSAIR VENGEANCE GAMING PC 5180

$2,399.00 (AS TESTED) EDITORS' CHOICE ●●●●○

The Corsair Vengeance 5180 is a sleekly designed, upgrade-friendly gaming desktop packed with the power to play any title smoothly. Our test model packed an Nvidia "Turing" GeForce RTX video card for superb gaming performance at resolutions up to 4K, as well as plenty of speedy SSD storage. And it looks great: Corsair's well-designed case with tempered glass and attractive, customizable lighting shows off a spacious, neat interior.

54 BUSINESS/DESKTOP WORKSTATION

HP Z2 MINI G4 WORKSTATION

$2,149 (AS TESTED) EDITORS' CHOICE ●●●●○

The Z2 Mini G4 is a compact desktop with the performance of a much larger workstation,

complete with ISV certifications and even the option for Xeon processors. Its proficiency is even more notable since certified, workstation-grade PCs of this size are few and far between. Architectural firms, financial modelers, research labs, and other customers who must have immense stable computing power at their disposal will swoon over this latest revision.

55 GRAPHICS CARD

NVIDIA GEFORCE RTX 2080 TI FOUNDERS EDITION

$1,199.99 ●●●●○

A Ferrari among gaming GPUs, the GeForce RTX 2080 Ti Founders Edition represents the fastest class of consumer-grade video cards that money can buy today. Just be ready to pay a supercar price to enjoy its luxury ride for 4K and high-refresh gaming. The GPU proper sets a new bar for single-GPU performance, yet it runs shockingly cool and quiet, and we were able to attain at least modest overclocks.

56 HIGH-END CPU

AMD RYZEN THREADRIPPER 2950X

$899.00 EDITORS' CHOICE ●●●●○

In 2017, the Threadripper line blew up the high-end-desktop CPU market and rocked Intel and its rival Core X-Series back on its heels. The 2018 revision of our favorite-value Threadripper chip brings incremental improvements to multi-threaded performance, thermal management, and overclocking. The 16-core 2950X makes AMD's flagship consumer CPU lineup even better than before, while retaining what made it great: tons of cores for the dollar, easy-to-use tweaking software, and access to all the PCI Express lanes you could ever want.

57 BUDGET CPU
AMD RYZEN 3 2200G
$99.00 ●●●●○

Four cores, four threads, and a base clock speed of 3.5GHz: If you're a casual gamer building a PC on a budget, you'll thrill to the Ryzen 3 2200G, an inexpensive CPU with built-in "Vega 8" graphics silicon that delivers better gaming performance than its price would suggest. Don't expect anything like the frame rates that you'd get with a desktop Radeon RX Vega card, but it's an excellent choice to power an inexpensive gaming PC and is well-provisioned for basic workloads, too.

58 INTERNAL SSD
SAMSUNG SSD 970 EVO
$179.99 (500GB, AS TESTED) EDITORS' CHOICE ●●●●◐

The Samsung SSD 970 EVO offers an excellent blend of throughput and endurance, making it the best high-end internal M.2 PCI Express SSD for most users. This proficient drive is the perfect complement to other high-end components, though it's overkill for more casual PC builds. Expect lightning-fast random reads and writes, as well as easy-to-use Windows software, all backed by a long warranty.

59 EXTERNAL HARD DRIVE OR SSD
SEAGATE FAST SSD
$169 (500GB, AS TESTED) EDITORS' CHOICE ●●●●○

With its on-point pricing and spiffy aluminum-shell design, the Seagate Fast SSD is a competitive external solid-state drive among the USB 3.0-interface set. Even better, it comes with both USB Type-C and USB Type-A cables and boasts decent read/write speeds. The aggressive cost per gigabyte applies at all capacities.

60 MOUSE
LOGITECH G903 LIGHTSPEED WIRELESS MOUSE AND POWERPLAY CHARGING MAT
$249.99 EDITORS' CHOICE ●●●●○

To be sure, this dynamic duo is premium priced. But the G903 Lightspeed wireless gaming mouse brings together a remarkably light and ready-tracking peripheral with virtually limitless battery life. Using the Powerplay mat, keep your mouse topped off while you work or play. Plus, the button position and mouse sculpting treat lefties and righties with equal respect.

61 KEYBOARD
CORSAIR K68 RGB
$119.99 EDITORS' CHOICE ●●●●○

It's not one of Corsair's hyper-deluxe K95 models, but this durable mechanical keyboard comes paired with great software for macro making and bling wrangling. The K68 RGB's

custom lighting is a bit tricky at first to master, but once you figure it out, the possibilities are endless. Authentic Cherry MX switches and dust/spill proofing make this keyboard with fine DNA a value-minded bargain.

62 MONITOR
BENQ EW3270U
$699.00 ●●●●○

The EW3270U offers UHD resolution (3,840 by 2,160 pixels, aka 4K), a crisp picture, and the ability to display HDR games and video. This 32-inch vertical alignment (VA) panel showed good color and grayscale accuracy, and it did well in our gaming testing. It's a well-rounded, big-screen entertainment monitor at a reasonable price.

63 INKJET MULTIFUNCTION PRINTER
HP TANGO X
$199.99 EDITORS' CHOICE ●●●●○

The HP Tango X, our first Editors' Choice for smart-home printers, is an all-in-one model whose forte is printing from mobile devices. It can interface with Amazon Alexa devices, Google Home, or Windows' Cortana, and it responds to voice commands. High costs for store-bought ink cartridges make it advantageous to enroll in HP's Instant Ink subscription program, which has an added bonus: It lets you print snapshots (up to 5 by 7 inches) from your smartphone for free, the paper cost aside.

64 MONOCHROME LASER
CANON IMAGECLASS MF424DW
$349.00 EDITORS' CHOICE

The imageClass MF424dw offers great value in a small- or home-office mono laser all-in-one. Its productivity and convenience features include a single-pass duplexing scanner, a large touch screen that can be customized with Canon's print apps, support for USB thumb drives, and relatively low running costs. Expandable paper capacity and a robust duty cycle suit it well for printing loads up to medium-duty.

65 COLOR LASER
BROTHER HL-L3270CDW
$249.99 EDITORS' CHOICE

The LED-technology HL-L3270CDW is fast for a low-volume color-laser-class printer, and it churns out excellent output across the board. Those aspects, combined with its 250-sheet paper tray, color touch screen, and wealth of connectivity choices, are more than enough to make it our top pick for light-duty use in home offices or small offices.

66 PHOTO PRINTER
EPSON EXPRESSION PHOTO HD XP-15000 WIDE-FORMAT INKJET PRINTER
$349.99 EDITORS' CHOICE

With six ink tanks and a wide range of connectivity features, the Expression Photo HD XP-15000 Wide-Format outputs gorgeous borderless photo prints up to supertabloid size (13 by 19 inches). In testing, the XP-15000 turned out some of the best photos we've seen from a printer not aimed at professional photographers. Though designed for home users, it's also a sensible jumping-off point for novices and would-be professional photographers.

67 PORTABLE PRINTER
HP SPROCKET 2ND EDITION
$129.99 EDITORS' CHOICE

The Sprocket 2nd Edition generates wallet-size prints from smartphones and tablets, and it even has an augmented-reality feature that makes a print—once it is associated with a video—seem to come alive when you view it with your phone's camera from within the Sprocket app. Its primo print quality, much better than what we have seen from other ZINK-based printers that use the same kind of no-ink-required paper stock, clinches its status as our top portable photo-printer pick.

68 3D PRINTER
DREMEL DIGILAB 3D45 3D PRINTER
$1,799.00 EDITORS' CHOICE

With the DigiLab 3D45, Dremel has shown that it is as good at building 3D printers as it is at making the power tools for which the company is famous. Among its virtues are its ease of

setup and use, above-average print quality, smooth operation, multiple connection choices, and safe and quiet design. The mid-priced 3D45 is a great choice for product designers, educators, hobbyists, and well-heeled consumers.

69 SCANNER
EPSON FASTFOTO FF-680
$599.00 EDITORS' CHOICE ●●●●○

Got loads of snapshots? You no longer have to scan them one by one. The FastFoto FF-680W is a sheet-feed desktop scanner built to scan stacks of up to 36 photo prints gently enough that they don't get ripped in the feeder. In testing, the FF-680W did well in scanning everything from 3-by-5-inch prints to 4-by-11-inch panoramas, and its software lets you sort and classify the scans. The FF-680W also does a credible enough job at document scanning that you won't think of returning it once you're done digitizing your shoeboxes full of snaps.

70 PROJECTOR
EPSON EX3260 SVGA 3LCD PROJECTOR
$449.99 EDITORS' CHOICE ●●●●○

The Epson EX3260 SVGA 3LCD Projector is a portable data projector for business or educational use whose low price is commensurate with its modest resolution. This printer has better image quality for both data and video than comparable models, so when you're not using it to give presentations, you could watch movies with it. Provided that your presentations don't contain very small type or finely detailed graphics, the EX3260 is a great, cost-effective choice.

71 BUDGET ROUTER
ASUS RT-AC66U B1 DUAL-BAND GIGABIT WI-FI ROUTER
$109.99 EDITORS' CHOICE ●●●●○

The RT-AC66U B1 is a value-minded dual-band router that's easy to install and feature-

packed, and it delivers solid throughput. Heads of household will also laud its robust parental controls. This router's support for Asus mesh-networking technology lets you add other Asus routers to your network later, to spread your coverage net without rebuying hardware.

72 HIGH-END ROUTER

ASUS ROG RAPTURE GT-AC5300

$399.99 EDITORS' CHOICE ●●●●◐

One of the fastest routers we've tested (it's based on a quad-core central processor), the tri-band ROG Rapture GT-AC5300 offers lots of gamer-friendly features, copious I/O (including eight LAN ports), and a slick management console that lets you optimize your network for lag-free gaming. Also, it works with Alexa voice commands and IFTTT applets.

73 HOME WI-FI SYSTEM

TP-LINK DECO M9 PLUS MESH WI-FI SYSTEM

$299.99 EDITORS' CHOICE ●●●●◐

The Deco M9 Plus is an excellent performer that offers a robust feature set, including the ability to serve as a home-automation hub that controls your personal army of smart home devices. We found it easy to install, and it delivered solid throughput in our tests. Built-in malware and virus protection, robust parental controls, and support for Alexa and IFTTT round out this winning mesh system.

74 NETWORK ATTACHED STORAGE

SYNOLOGY DISKSTATION DS718+

$399.99 EDITORS' CHOICE ●●●●○

The DS718+ is a versatile, feature-packed, two-drive NAS that delivers solid performance. Easy to install and backed by loads of add-on apps in Synology's app store, it runs off of a quad-core CPU and on Synology's user-friendly DiskStation Manager (DSM) operating system. Press it into service as a total backup solution, an email and media server, a personal cloud server, and more. It also supports on-the-fly 4K video transcoding.

"One of the fastest routers we've tested, the tri-band ROG Rapture GT-AC5300 offers lots of gamer-friendly features."

75 GAMING MONITOR
ASUS ROG STRIX XG32VQ

$699.00 EDITORS' CHOICE ●●●●○

The ROG Strix XG32VQ's wickedly curved 31.5-inch VA panel, zippy 144Hz refresh rate, and FreeSync support alone make this mega-display worth consideration as a serious gaming monitor. Throwing in a raft of gaming-centric features (plus bright color performance, good contrast, and smooth gaming in our testing) makes it our Editors' Choice large-screen gaming monitor.

76 GAMING HEADSET
STEELSERIES ARCTIS PRO WIRELESS

$329.99 EDITORS' CHOICE ●●●●○

The Steelseries Arctis Pro Wireless feels comfortable and sounds excellent, and it's loaded with useful features. It comes with two batteries so you don't need to plug it in to keep playing, its base station has its own display and control knob for adjusting settings, and the headset itself can even function as a pair of Bluetooth headphones.

77 VR HEADSET
OCULUS RIFT

$399.00 EDITORS' CHOICE ●●●●○

Oculus helped bring virtual reality back to the high-tech table, and the Rift remains one of the best tethered VR headsets. It's the same device released two years ago, but a series of price cuts and the inclusion of the excellent Touch controllers make it even more appealing today.

78 GAME CONSOLE
NINTENDO SWITCH

$299.99 EDITORS' CHOICE ●●●●○

The Nintendo Switch is a year and a half old and has already proven its value. This game system can work like a home console docked to your TV or as a handheld game system, and it's remarkably effective in both modes. Add an incredibly strong library for its first year with

some absolute must-haves along with a variety of excellent indie games and classic ports, and you have the game system of the generation.

79 PLAYSTATION 4 GAME
GOD OF WAR
$59.99 EDITORS' CHOICE

Sony's God of War franchise has delivered over-the-top action and inspiring fantasy settings for multiple console generations, though it's never showcased technical combat. That changed in the new God of War, a game that streamlines the combat and controls while radically expanding the scope of the game world. God of War doesn't reinvent the action genre, but its extremely polished, technical gameplay borrows elements from popular action titles to create something unique yet pleasantly familiar.

80 XBOX ONE GAME
FORZA HORIZON 4
$59.99 EDITORS' CHOICE

Some questioned Forza Horizon 4's necessity, given that the open-world racer debuted just two years after its excellent predecessor. But developer PlayGround Game has taken its incredible Horizon racing-and-music festival formula and added even more goodness, including new vehicles, fresh and addicting solo and multiplayer modes, and seasonal effects that impact the environment and change how you approach driving. Simply put, Forza Horizon 4 is the best racing game on Xbox One—and the best this console generation.

81 NINTENDO SWITCH GAME
NINTENDO LABO VARIETY KIT
$69.99 EDITORS' CHOICE

Nintendo already proved it could make strange concepts work with the Switch itself, which functions as both a home game console and a handheld. It went even further with the Labo Variety Kit, a cardboard craft set that lets you build your own game controllers—handlebars, a piano, and a fishing rod, for example. You can even come up with your own inventions in the Toy-Con Garage.

82 PC GAME
MONSTER HUNTER WORLD
$59.99 EDITORS' CHOICE

Monster Hunter World came to the PC months after its console counterpart arrived, but the game was unquestionably worth the wait. The action-RPG features significant improvements to the classic hunt-and-loot Monster Hunter formula (streamlined controls, uncapped frame rates) to make it more newcomer-friendly than previous iterations. Still, mastering a weapon takes time, and perfecting your fight against a monster takes even longer. If you've longed to give the Monster Hunter series a go, World is a terrific starting point.

83 SECURITY SUITE
KASPERSKY SECURITY CLOUD
$149.99 PER YEAR EDITORS' CHOICE ●●●●◐

Kaspersky Security Cloud is a cross-platform multi-device security suite that lets you install and manage Kaspersky security on up to 20 PCs, phones, and tablets at an impressively low per-device price. Its features go beyond basic security, including parental control, password management, VPN, and more, all managed in a convenient online dashboard.

84 STANDALONE ANTIVIRUS
BITDEFENDER ANTIVIRUS PLUS
$39.99 PER YEAR EDITORS' CHOICE ●●●●◐

Bitdefender Antivirus Plus gets top scores from the independent labs, and it comes with a collection of features that puts many security suites to shame. Among other things, it offers password management, dedicated ransomware protection, online banking protection, and a scan for missing security patches.

85 VPN SERVICE
NORDVPN
$11.95 EDITORS' CHOICE ●●●●●

NordVPN excels by offering more than anyone else. An $11.95 monthly account gets you six simultaneous connections and access to NordVPN's network of 5,100 servers in 62 countries. The company takes privacy and security seriously, collecting minimal data from users. Notably, NordVPN offers double VPN, one-click access to the Tor network, and other features unique or not often seen among the competition. With apps for every platform, it's the go-anywhere, do-anything VPN.

86 PASSWORD MANAGER
KEEPER PASSWORD MANAGER & DIGITAL VAULT
$29.99 PER YEAR EDITORS' CHOICE ●●●●◐

With a strong focus on security, Keeper Password Manager & Digital Vault works on all popular

platforms and browsers, maintaining a consistent interface across them all. Its high-end features include two-factor authentication, secure credential sharing, and a provision to pass on your passwords to a designated heir. You can also use it as a secure online vault for your sensitive files.

87 PRIVACY PROTECTION

ABINE BLUR

$39 PER YEAR **EDITORS' CHOICE** ●●●●◐

Worried that your online activities are giving away too much? Abine Blur lets you shop online without revealing a thing. It masks your actual email address, phone number, or credit card number, and it manages your passwords, too. If you get spam on a masked email address or phone number, you simply delete it. And a crooked merchant can't charge you a dime more than the amount specified with your masked credit card number.

88 DESKTOP OPERATING SYSTEM

WINDOWS 10

FREE UPGRADE **EDITORS' CHOICE** ●●●●◐

Microsoft continues to advance the state of the desktop operating system art, with free updates, groundbreaking capabilities like the Cortana voice-controlled digital assistant, and more. For businesspeople and gamers, Windows stands alone with unmatched deployment options and graphics support. It's the only desktop operating system with rich VR and AR support, including for Oculus Rift, HTC Vive, Windows Mixed Reality devices, and Steam VR. But just for everyday working with windows and files, the OS offers many slick, unique conveniences.

89 MOBILE OS
APPLE iOS 12
FREE EDITORS' CHOICE

iOS 12 lets you take back control of your life with a slate of new features designed to make you use your phone less. Screen Time lets you set limits for how long you use your phone, and Downtime grays out your apps when it's close to bedtime. A surprise addition is the standalone Shortcuts app, which lets you create custom scripts for you iOS device—a first for an Apple mobile devices.

90 PHOTO EDITING
ADOBE PHOTOSHOP CC
$9.99 PER MONTH EDITORS' CHOICE

A product doesn't become a verb in the English language unless it's done something well. Photoshop continues to be in a league of its own when it comes to digital photo manipulation. It's also the top raster-drawing app on the planet for graphic artists. Adobe continually improves its photo, art, and text creativity capabilities. Of late, the company has added Sensei AI technology, making the already-brilliant Content-Aware Fill tool better. It also improved selection and masking tools and added support for the Microsoft Surface Dial. The completely re-engineered Profiles from Camera RAW are a boon to photographers. The program's interface also continues to make complex workflows and actions simpler. Photoshop is a longtime leader, but it's not sitting on its laurels.

91 VIDEO EDITING
CYBERLINK POWERDIRECTOR
$129.99 EDITORS' CHOICE

This massive video-editing program from Taiwanese media software maker CyberLink is always ahead of the curve when it comes to new standards and techniques in video editing. It was the first in its class with robust support for 360-degree video editing, and the company continues to beef it up with ever more powerful tools. The latest update added pro-level color grading, nested projects, new text effects, AI art effects, improved chroma keying, and clip precutting.

92 AUDIO EDITING
APPLE LOGIC PRO X
$199.99 EDITORS' CHOICE

While the powerful Avid Pro Tools continues to garner the most name recognition, Logic Pro X remains our favorite digital audio workstation (DAW) software in 2018. It comes with awesome-sounding virtual instruments, flexible editing tools, and top-notch mixing plug-ins. Although it's not the least expensive DAW on the market, it costs just $199—hundreds less than other well-established competitors. For songwriting and recording bands, post-production, and even scoring for video games and movies, you can't go wrong.

93 VIDEO STREAMING SERVICE

NETFLIX

$7.99 PER MONTH EDITORS' CHOICE

Netflix is the home of some of the best original series, including *Altered Carbon, Black Mirror, Bojack Horseman, Disenchantment, Mindhunter, Narcos, Orange Is the New Black, Ozark, Stranger Things,* and *The Crown.* On top of that, Netflix is ad-free, available on tons of platforms, and priced competitively. The service also hosts 4K and HDR content and lets users download titles for offline viewing.

94 MUSIC STREAMING SERVICE

SLACKER RADIO

FREE, WITH PREMIUM OPTIONS STARTING AT $3.99 PER MONTH EDITORS' CHOICE

Slacker Radio began life as the human-curated alternative to the pioneering Music Genome Project–powered Pandora Internet Radio. Since then, however, Slacker Radio has expanded to include news and weather updates, entertaining lifestyle channels, ridiculously knowledgeable hosts, well-conceived themed stations, and even short stories that are sure to delight music fans. It's truly radio for the digital age.

95 PRODUCTIVITY

ASANA

$11.99 PER MONTH EDITORS' CHOICE

As far as collaboration and project management software goes, Asana is top-notch. Its flexible design and task-based structure makes Asana usable across a wide range of industries and projects. In recent updates, Asana even gained a Timeline view with dependencies, as well as a board view, so both the Gantt- and Kanban-faithful should feel at home. Advanced search and reporting features add significant value.

96 CLOUD STORAGE & SYNC

MICROSOFT ONEDRIVE

FREE, $1.99, $6.99 EDITORS' CHOICE

OneDrive combines cloud-based file and folder storage and syncing with online productivity apps and photo viewing. The recent Files on Demand feature means you don't have to store everything you sync to your local storage device. Sharing and co-editing with collaborators is well-implemented, including password protection and expiration dates for share files. The latest version even includes ransomware protection with notifications and recovery options. Excellent mobile apps complement the service. OneDrive's tight integration with Office apps and Windows 10 make it indispensable. With a $6.99-a-month Office 365 subscription, you get a whopping 1TB of storage.

97 ONLINE BACKUP

IDRIVE

$69.50 PER YEAR EDITORS' CHOICE

Backing up your hard drive is not difficult when you use the right software. IDrive makes it easy to set up and schedule backup tasks for files on any of your storage devices. Furthermore, IDrive allocates a generous 2TB to subscribers of its base plan. IDrive's mobile apps can also automatically back up photos and videos, as well as other data such as SMS texts and call logs.

98 WEBSITE BUILDER

WIX

FREE; $29 PER MONTH EDITORS' CHOICE

Wix continues to lead the way in do-it-yourself website creation. The service's offerings are among the easiest and the most powerful we've tested. Get started with a huge selection of attractive, modern templates, use Wix AI to automatically generate a site, and add intelligence through Wix Code. You can even test the waters with one of the industry's most generous free website offerings. If you want to sell items, services, or book appointments on your site, Wix has you covered.

99 WEB HOSTING SERVICE

HOSTWINDS WEB HOSTING

STARTING AT $4.50 PER MONTH EDITORS' CHOICE

If you want a powerful and flexible web-hosting service, look no further than the marvelous Hostwinds. It offers an array of shared, VPS, dedicated, cloud, WordPress, and reseller hosting packages designed to appeal to both mom-and-pop shop owners and bigger businesses. In fact, Hostwinds' feature-packed VPS and reseller offerings make it our top pick in those categories. Overall, Hostwinds is one of the most flexible and feature-rich web hosts we've tested.

100 PERSONAL FINANCE

MINT

FREE EDITORS' CHOICE

Mint is an excellent personal finance service that has won multiple Editors' Choice awards thanks to its simplicity, usability, and smart blend of financial tools. It lets you set up connections to all of your online finance accounts, check your credit score, and get a good estimate of your net worth. Mint is easy to access on your smartphone and even on your Apple Watch. Even better, Mint is an ad-supported, free service, so you can give it a go without opening your wallet.

101 MOBILE PAYMENT APP

VENMO

FREE EDITORS' CHOICE

Who uses cash anymore? It's so dirty and inconvenient, especially if you have to make change. With Venmo, you can pay your friends or even your landlord without sullying a finger. Venmo also works as a social network of money, so you can see whom your contacts are paying. Venmo even lets you split payments for that night out with a group of friends—no more splitting the check or doing math that often feels unfair. Newer perks include a QR code for receiving payments easier, the ability to pay onlines stores, and Siri and iMessage integration.

102 CRYPTOCURRENCY WALLET

COINBASE

FREE EDITORS' CHOICE

For those who've long wanted to get into the cryptocurrency craze, Coinbase is the wallet that makes doing so the easiest—and the safest. It doesn't offer as many cryptocurrencies as some competitors, but it's reputable, and it offers two-factor authentication. The app gives you a clear view of your total crypto holdings, daily trends, and a vault that supports multi-signatures. If you're hankering to get into the crypto game, Coinbase is your best bet.

103 EDUCATION & LEARNING SERVICE

ROSETTA STONE

$179.00 EDITORS' CHOICE

Rosetta Stone is a great way to learn a new language, since it offers a variety of different language-learning activities, including speaking, writing, reading, and listening exercises. Users even get the option to join live tutoring sessions with other people via video conference for further practice. Although Rosetta Stone likely won't make you fluent in your language of choice, its intuitive mobile and desktop apps make it an excellent companion tool.

104 TRANSCRIPTION SERVICE

REV

$1 PER MINUTE EDITORS' CHOICE

Rev is a modern and accurate transcription service that returns files quickly. Simply upload a file from local storage or add a link to a file on the web. Rev gives you control over how your file is transcribed, including options for speaker identification and timestamps. One of Rev's best features, however, is its top-notch web editor, which enables users to easily make corrections to the completed transcript.

105 APPS FOR WRITERS

SCRIVENER

$45 EDITORS' CHOICE

Scrivener, now in in its third release, is an excellent, cross-platform writing app that mitigates some of the biggest pain points of creating, organizing, and editing long-form works. Take for

example, its excellent Corkboard feature, which lets you easily rearrange chapters or sections of your writing without any fuss. Note that Scrivener supports WYSIWYG formatting, which is helpful for writers who don't want to learn Markdown language.

106 DNA TESTING SERVICE

23ANDME

$199.00 EDITORS' CHOICE

Who among us isn't curious about their roots? DNA test kits not only show your ancestral composition but can also alert you to genetic health risks. 23andMe is the most well-rounded of the lot; it's easy to use and frankly, fun. The service even tells you whether you're related to famous historical figures and how much Neanderthal you contain.

107 MEAL KIT DELIVERY SERVICE

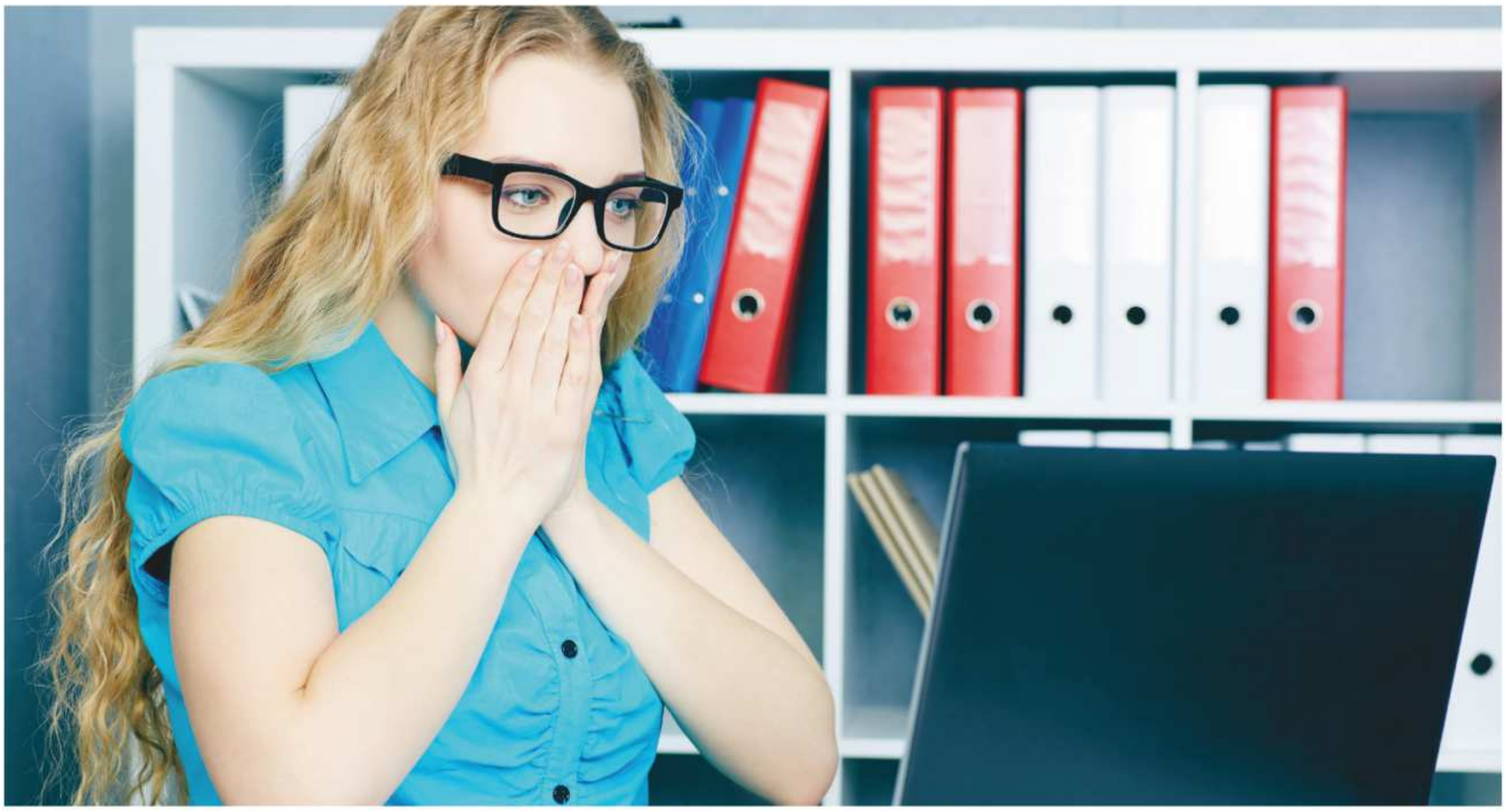
SUN BASKET

$11.99 A MONTH EDITORS' CHOICE

Meal kit services can feel a little bit frivolous at first, but the ease of one-click meal planning, pre-portioned ingredients, and the satisfaction of a home-cooked meal is hard to beat. While many meal delivery services are excellent (Blue Apron is our other favorite, and an Editors' Choice), Sunbasket stands out. Its wide range of recipes range from comfortable and quick to adventurous and challenging. We especially appreciate how many different dietary options are available for vegetarian, vegan, and gluten-free cooks.

How to Recover Deleted Files From an Online Storage Site

BY LANCE WHITNEY



You use an online storage site such as Box, Dropbox, Google Drive, iCloud, or Microsoft OneDrive to back up and synchronize your files in the cloud. Now a document, photo, or other important file has gone missing. You've looked on your computer and scoured the folders on the storage site, but the file is still nowhere to be found. But don't give up.

Online storage sites usually offer a recycle bin or trash folder that holds deleted files. You can browse or search the trash folder for your missing file by name, wildcard, and other attributes. And most sites hang onto deleted files for up to 30 days. After the clock has run out, those deleted files are purged and typically removed from the file servers, so you'll want to check your storage site sooner than later. The basic process is the same across the major storage sites, but the steps differ slightly. Here, we'll look at each one to see how you can recover deleted files.

Box

Sign into your Box account. Open the Trash folder to hunt for your missing file. You can also search for the file by name through the Search field. Right-click the file and click on Restore.

Dropbox

With a free Dropbox personal account, you have up to 30 days to restore a deleted file. A Dropbox Business account raises that to 120 days. Sign into Dropbox. At your Home page, click on the link for Files and then select the link for Deleted Files. Browse or search for the file you want to recover. Click on the file and select Restore from the pop-up window.

Google Drive

Sign into Google Drive. Click on the Trash icon. Look for the file you wish to restore. If you can't locate it, seek out the file by typing its full name or entering wildcards in the Search field. Google Drive alerts you if it finds the file in the Trash. Click on View to see the file in the Trash folder. To restore it, right-click on the file and click on Restore.

iCloud

Sign into iCloud. Click on the Settings icon. In the Advanced section, you can opt to restore deleted files, contacts, calendars and reminders, and bookmarks. Click on the desired option, such as Restore Files. Select the file you need and click on Restore. You can also jump directly to iCloud Drive. In the lower right corner, click on the link for Recently Deleted. If your missing file pops up here, select it and click on Recover.

Microsoft OneDrive

I rely on OneDrive to sync my files in the cloud and have sometimes used its Recycle bin to revive deleted documents. To do this, open your OneDrive storage space. Click on the entry for Recycle bin. From there, browse the list of deleted files or search for specific files by name, extension and/or wildcards. To restore a file, select it and click on Restore. You can also opt to restore all items in the bin.

How to Flush Your DNS Cache

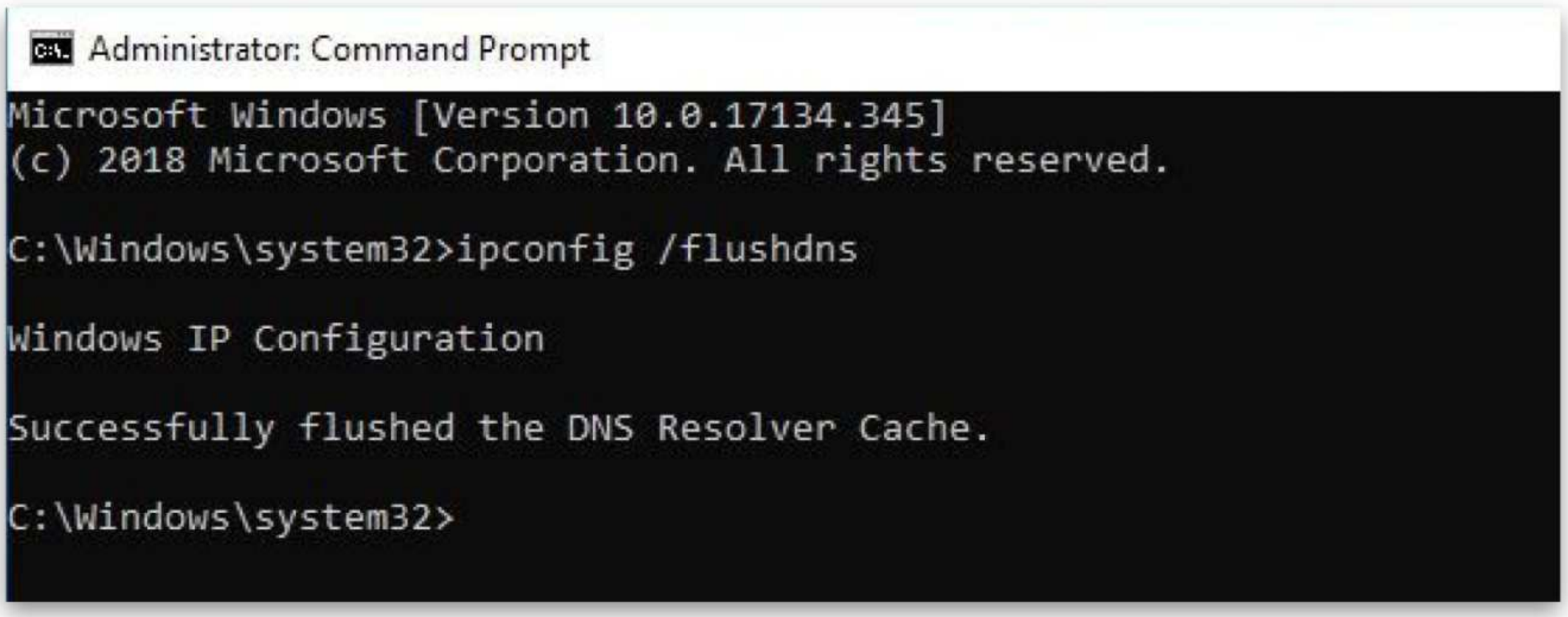
BY WHITSON GORDON

When you type a website into your address bar, your computer doesn't actually know where to go on its own. Instead, it looks up that address on a Domain Name System (DNS) server, which matches it with an IP address for your computer to visit.

To speed this process up, your computer saves some of these entries for easy access later on. This allows your computer to navigate to sites you've already visited without asking the DNS server every time. Unfortunately, on rare occasions, this cache can cause problems.

Maybe the site you're visiting changed servers and is no longer located at the cached address, or maybe you have some malware that's trying to redirect common pages to malicious sites. Whatever the case, you can "flush" your DNS cache to start from scratch, so your computer looks up web addresses on the DNS server again.

This process is, of course, different from clearing your web cache from a web browser. If clearing your browser's cache has not solved the problem, clearing your DNS cache may be the next step. Here's how to do it on Windows and macOS using the command line. (If you're using Linux, you'll need to look up instructions for your particular distribution.)

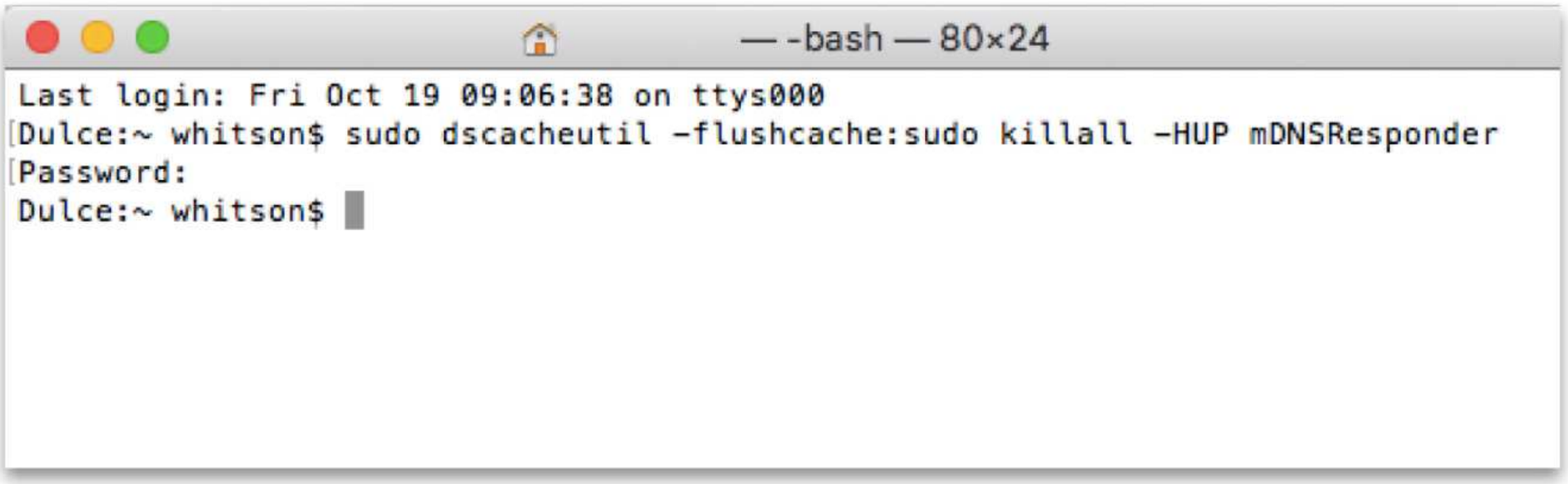


FLUSH THE DNS CACHE ON WINDOWS

If you're on a Windows machine—any Windows machine, even going back to XP and older—flushing the DNS merely takes a simple command. Click the Start menu and type "cmd." Right-click on the Command Prompt option and choose "Run as Administrator." In the Command Prompt window that appears, type the following command:

ipconfig /flushdns

If it's successful, the Command Prompt reports back with "Successfully flushed the DNS Resolver Cache." Try visiting the website in question again and see if that solved the problem. If not, the site may be down, you could be having Wi-Fi problems, or you may have a more elusive network problem on your end that needs to be tracked down. If this is someone else's computer, you can always try troubleshooting remotely.



FLUSH THE DNS CACHE ON A MAC

Mac users need to run a quick Terminal command to flush the DNS cache, but the command differs depending on your version of macOS. First, press Command+Space to open Spotlight and search for “Terminal.” Press Enter to open it.

Most modern versions of macOS—from OS X Lion through macOS Sierra—use the following command. Type it into the Terminal and press Enter:

sudo dscacheutil -flushcache;sudo killall -HUP mDNSResponder

If you’re on OS X 10.10.1, 10.10.2, or 10.10.3, you’ll need to run this command instead:

sudo discoveryutil udnsflushcaches;sudo discoveryutil mdnsflushcaches

You won’t see a success message for either command, but you can check the problematic website and see whether this fixed the problem.

What's on Our Mobile Expert's Phone Screen?

BY AJAY KUMAR

When you've reviewed hundreds of phones, from the latest glass-clad flagships that cost half a month's salary to the less-spectacular phones you can buy with loose change, it's easy to lose sight of the fact that what makes a smartphone useful is not just the hardware: The apps you use matter just as much.

As a mobile analyst at PCMag, I've refined the process of setting up phones and installing apps to an art form. I can start benchmark-testing the average smartphone in a matter of minutes. But my daily carry, the Samsung Galaxy S9, requires a bit more thought about what shows up on my home screen. Here are some of the apps I rely on.

Audible

I don't have time to read. OK, that's not completely true; I could certainly find the time if I wanted to, but reading is still hard to fit into my schedule. Audible is a lifesaver for me as a book lover (and aspiring fantasy writer), because it lets me listen to audiobooks while I'm commuting, doing laundry, working out, washing dishes, and filling out spreadsheets—essentially, it turns all the dead time in my day into entertainment time. A testament to Audible's awesomeness is my listening time: I clocked over 64 hours in the month of October, which equals four weighty tomes I'd never have read otherwise.

Pocket Beta

When I scroll through Twitter in the morning, I see plenty of links to long, interesting articles and think pieces. Pocket lets me open links and save articles offline, so I can read them while I'm (inevitably) stuck on New Jersey's PATH train. There's also a handy AMOLED theme that sets the background to black and makes the text white, saving juice while I read. Pocket is one of the few things that keep me sane during interminable commuting delays.

Boost for reddit

Plenty of apps can browse reddit, including the official ones—but I use Boost for reddit because it has a great range of customization options. You can control the theme and fonts, decide where various panels appear, set up post and content filters, back up content, and easily switch between multiple accounts. All that's missing are push notifications to your phone, but you can set those up by linking Boost to the official reddit app.

Signal

I use quite a few messenger apps to keep in touch with friends and family, but I never use the default one that comes with the phone. To send my text messages, I rely on Signal. It's private and fully encrypted end to end (when you text another Signal user), and you can lock the app to make it require fingerprint verification. You can also link other devices to send messages securely from your desktop. Maybe I'm para-

noid, but it works as well as Samsung or Google's default messenger and gives me peace of mind regarding privacy. Now if only I could quit social media, too.

Rev Voice Recorder

As a journalist, I often interview people, but it's tough to have a natural conversation when you're peering at someone over a laptop screen. Rev is a voice-recording app that's connected to a transcription service. When I start an interview, I turn on Rev, save the recording, and send it off to the service's human transcriptionists, who produce a full, fairly accurate transcript of the interview within a very reasonable time (depending on the length of the recording). From there, it's a breeze to find quotes for my articles and pick out relevant statements.

iSmartAlarm

I live in a rental apartment, so most smart-home security options aren't really relevant to me. But I did set up a couple cameras and motion sensors, so I can be sure no one's rifling through my Nintendo amiibo collection when I'm not home. With the iSmartAlarm app (which requires the separate installation of a hub, camera, and motion sensors), I can check on my apartment, view what the cameras by the door are seeing, and make sure that the window sensor was set off by an overeager squirrel rather than a burglar. The app is simple but works well enough: I can arm or disarm the system remotely, hit a panic button to ring a siren, and easily reset it when I'm home. And I haven't been robbed yet.

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