

INSIDE: 7 THINGS I LEARNED ONCE I BUILT MY FIRST PC

PCWorld

SEPTEMBER 2016

FROM IDG

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→ **Project Alloy** could be Intel's savior



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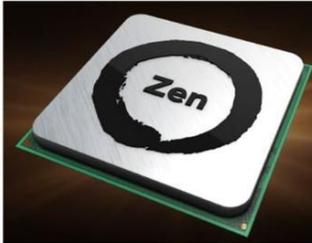
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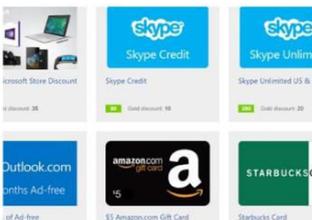
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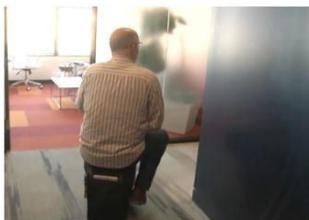
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PUBLICATION INFORMATION

Volume 34, number 9 *PCWorld*™ (ISSN 0737-8939) is published monthly at \$24.95 for one year (12 issues) by IDG Consumer & SMB, Inc. Copyright 2016, IDG Consumer & SMB, Inc. All rights reserved. *PC World* and Consumer Watch are registered trademarks of International Data Group, Inc., and used under license by IDG Consumer & SMB, Inc. Published in the United States.

MAKE BREAKFAST HAPPEN SO KIDS CAN BE HUNGRY FOR MORE

Photo By: Peggy Sirota



I was one of our nation's hungry kids growing up. Today, 1 in 5 children in America struggle with hunger. But when they get breakfast, their days are bigger and brighter. Learning, attention, memory and mood improve. Together, we have the power to get breakfast to kids in your neighborhood — let's make it happen. Go to hungeris.org and lend your time or your voice.

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Let the CPU wars begin: AMD shows its Zen CPU can compete with Intel's best

BY GORDON MAH UNG

AMD FINALLY UNVEILED its new Zen microarchitecture, with a pair of CPUs that could put the company back into the fight with Intel's best.

AMD said its Summit Ridge CPU, aimed at high-performance

desktops, will pack 8 cores and feature simultaneous multithreading technology to give it 16 threads of processing power. Summit Ridge is targeted for Q1 2017, though a trickle of chips could appear sooner. A second chip for servers, code-named Naples, will feature an astounding 32 cores with SMT, giving it 64 threads per CPU. SMT is similar to Intel's Hyper-Threading technology, which splits a single core into two virtual cores for more performance.

To prove that Zen has the right stuff, AMD officials recently demonstrated before a crowd of reporters and analysts that an 8-core Zen could run just as fast as Intel's newest 8-core consumer Core i7 chip.

Why this matters: Up to now, some had speculated that Zen would fall short. Recently leaked benchmarks seemed to indicate it was no better than Intel's Haswell microarchitecture released more than two years ago. If other tests back up AMD's demonstration, however, it

If other tests back up AMD's demonstration, however, it appears to run neck-and-neck with the newly released Broadwell-E.



AMD's Summit Ridge SoC (left) running at 3GHz can run a Blender render just as fast as a Core i7-6900K (right) running at 3GHz.

appears to run neck-and-neck with the newly released Broadwell-E. If AMD can live up to its promise, it's great news for the company as well as for consumers.

Clock-for-clock, it's looking fast

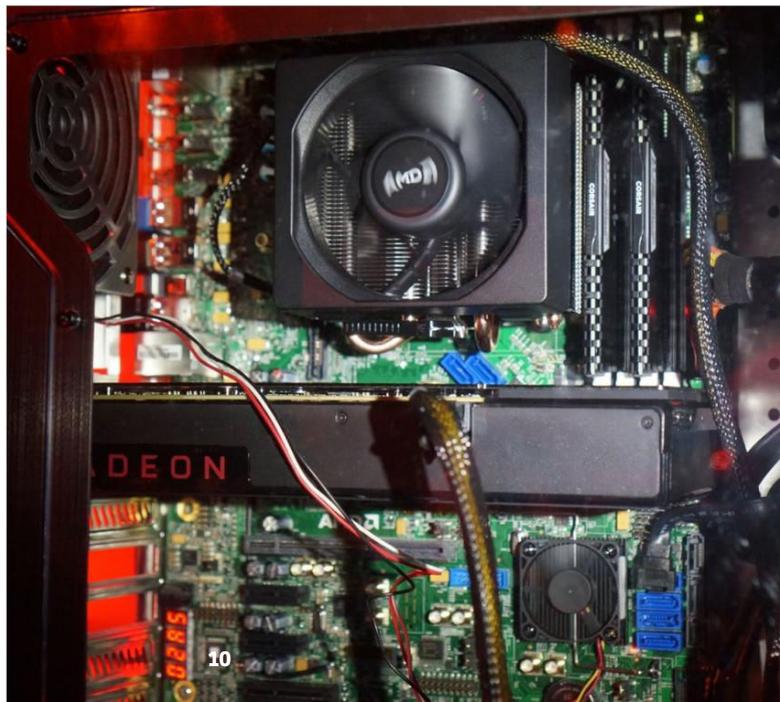
The demonstration used the multithreaded Blender rendering application on two similarly configured PCs. One featured an engineering sample Summit Ridge chip, while the other featured a new Intel Broadwell-E Core i7-6900K CPU. While the Core i7-6900K can run up to 4GHz on some workloads, AMD conducted the test with both CPUs locked at 3GHz.

This methodology may seem unorthodox to some, but matching the chips clock-for-clock helps reveal their efficiencies. Conducting the test this way also helps AMD protect the final shipping clock speeds of the chips. In the demo, which was performed just once, the Zen finished a nose ahead of the Broadwell-E Core i7-6900K chip.

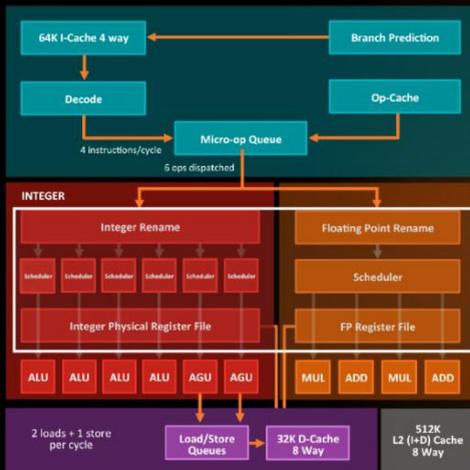
It's just a single test on an unreleased CPU, and under the control of AMD. Still, the significance of the performance feat quells any fears that Zen would be the all-too-familiar "too little, too late" story from a company that has eaten Intel's dust.

The demonstration exceeded the crowd's expectations. "This is the most exciting AMD

AMD's Zen will fit into the new AM4 socket and appears to support dual-channel DDR4.



DESIGNING THE ENGINE: PERFORMANCE



QUANTUM LEAP IN CORE EXECUTION CAPABILITY

- ▲ Enhanced branch prediction to select the right instructions
- ▲ Micro-op cache for efficient op issue
- ▲ 1.75X instruction scheduler window*
- ▲ 1.5X issue width and execution resources*
- ▲ Result: instruction level parallelism designed for dramatic gains in single-threaded performance

*Compared to Excavator

(CPU) launch in a decade,” said Kevin Krewell, principal analyst with Tirias Research, who attended the event. “They really have hit the mark on this.”

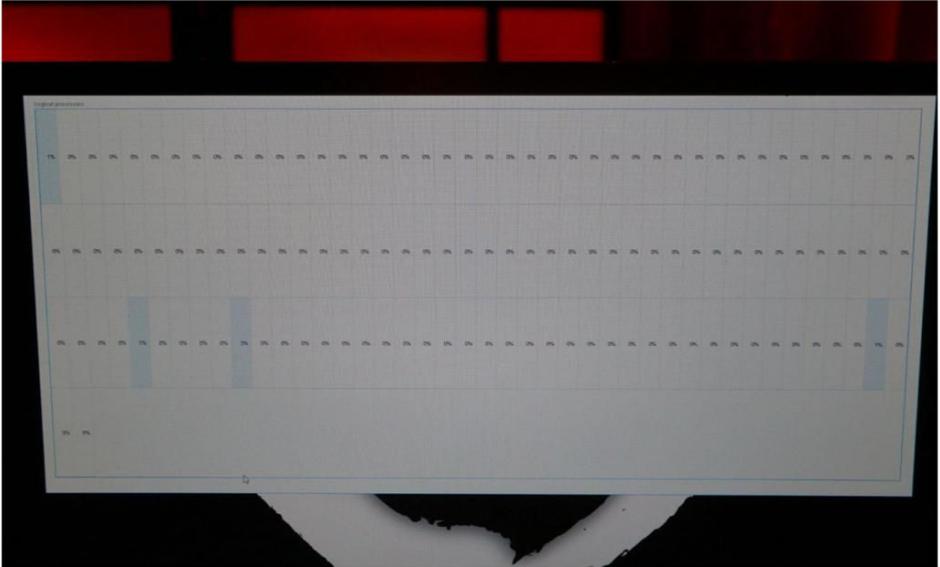
Performance, throughput, and efficiency

AMD officials also lifted the curtain on Zen’s completely new microarchitecture. Gone are the shared, clustered multithread cores of the previous Bulldozer and Piledriver designs—Zen’s cores are stand-alone cores with SMT. The chip is being fabbed by spin-off company Global Foundries on a 14nm process, using FinFET technology.

AMD CTO Mark Papermaster said the Zen core is about performance, throughput, and efficiency. Papermaster said Zen features a new high-performance cache, a greatly improved prefetcher, and a completely redesigned branch prediction unit.

This is a big deal for AMD, and Papermaster showed it. “It’s a thrill to

AMD’s new Zen is a completely new CPU demonstrating a big performance boost over previous designs.



tell you we fully validated our performance achievement,” he said, beaming. He also promised that AMD was just warming up. “We are back. I told you a year ago we are back. And I’m very happy to tell you we delivered that performance and the team is not stopping, they are full forward on the next-generation design.”

The Summit Ridge chips are actually SoCs and will support DDR4, USB 3.1 10Gbps, NVMe, SATA Express and PCIe 3.0. Other details of Summit Ridge such as die size, transistor count, and thermals weren’t released the night of the demonstration.

Naples brings 32 cores and 128 threads

It’s not just about the desktop, either. AMD also wowed the crowd by demonstrating its server-oriented Naples SoC running in a dual-processor system. With each Naples packing 32 cores and SMT, that means a Naples-based server would feature 128 threads of compute power.

Officials said Zen will continue to evolve—the new chip design will

Here’s what 128 threads of computing looks like on a dual-processor AMD Naples-based server.

WE ARE BACK, AND JUST GETTING STARTED!



*Based on AMD Internal Testing

scale down to laptops sometime next year. But first AMD needs to ship these first Zen chips.

The consumer-focused Summit Ridge is expected to hit shelves in the first quarter of 2017, but AMD officials said some limited chips may ship in systems as soon as the end of this year. The server-oriented Naples chip would hit in the first half of 2017. "I told you the best is yet to come," said AMD CEO Lisa Su. "The next 12 months will be even more exciting." 🔌

AMD promised more than a year ago the new Zen CPU design would be 40 percent faster than its previous chip and it claims to have hit the mark.



Zen Q&A with AMD's CTO: 'We're bringing competition back to high-performance x86'

BY GORDON MAH UNG AND MARK HACHMAN

After being frankly astounded by AMD's recent demonstration of its Zen microprocessor, we simply had to sit down with AMD chief technical officer Mark Papermaster to find out more. Here is our interview, lightly edited for length and clarity. (Confused by what we're talking about? You might want to read our Zen performance report on page 8 before diving in.)

PCWorld: Wow. Leading up to this, there were a lot of doubts on the Internet about Zen's performance, that it could be lower than Intel's Ivy Bridge. Clearly, you guys have demonstrated that you can run with Intel's biggest dogs.

Papermaster: What we said a year ago—I guess it was in May, at the financial analysts' meeting, and I know when I put down that 40-percent IPC number, I got a lot of looks back, saying, "Really?" But the team was so focused. It was a very proud team at AMD. And they've had such a history of great designs.

And as I showed in my presentation, it's been innovation after innovation. We had let a gap develop in CPU performance. This was a great job by the team, to bring us back.

Zen had been in development for how long?

Not quite four years.

Clearly you're in a chess game with Intel. When Intel reads these stories, I wonder if they're going to cut prices. Do you keep prices low and go for as much volume as you can with Zen, or keep them high and raise your profit margins?

As you heard Jim Anderson say, who runs that business, they'll make those pricing decisions on those products. But the main thing we're showing today is just that: We don't want any of that fear, uncertainty, and doubt.

We're working with OEMs and ODMs. And as we come up to shipment, and the timeframe that we described today, the market should be confident. We're confident. Our customers—we're working with them under NDA—they see the restricted information. But there's no reason to have the market doubting if we're real, if we hit the performance target we set out for with the Zen core. We did. That's what we were able to not only share with you, but also demonstrate.



Would you say that the CPU wars are back on again, after being on a break for the past few years?

There's always been competition, or the CPU wars. What we did is we drove an incredible efficiency in the CPU roadmap that we showed you here. So if you look at the "Excavator" core, the previous generation that we compared for you, it does amazingly well if we target its sweet spot, which is in our PC market.

Look at some of the 7th-generation APUs leveraging that Excavator. It's in 28-nanometer. It's in great performance per watt, it's got the Radeon graphics with it, the battery life is a massive jump over the previous generation. But the war we're bringing back is to high performance. We're bringing competition back to high-performance x86.

But the war we're bringing back is to high performance. We're bringing competition back to high-performance x86.

What about more average users, who don't care about such high-end performance? When do we get a quad-core Zen?

Well, we'll start with the desktop configuration we [talked about]. And when you think about the rest of the markets, you'll see it permeate, as we complete that Zen rollout. What we said was that in the second half of 2017 there will be an APU—take that same Zen core and bring it into an APU configuration. We didn't release too far in advance the details of that, but that's when you're going to see the permeation right into our mobile PC markets.

So it really will scale? You'll be able to get Zen into a laptop, with reasonable power?

It's designed for scalability. The key points I made are twofold: microarchitecture and design methodologies. I showed you this whole history of our prior cores; there was no FinFET. What I showed you was a bigger gap in [our] foundry versus Intel's foundry capabilities. That drove us to really hone the techniques in energy efficiency. We applied all of that to the Zen core design. Then we leveraged FinFET. That

combination gives us tremendous scale.

Just to clarify: you guys said that your thermal design power will be “competitive” with Intel. What does that mean? Will you match them, TDP for TDP?

As you heard Jim Anderson say, we’re not going to match TDPs for TDPs. Because that’s the spec that goes out on each product as we ship. But what we said is that we’ll be competitive by core, and have competitive designs. That means that they have to drop into the ecosystem. And that means form factors and product specifics.

Does that mean tablets, too?

What we’ve said is that with this generation of products we’ll put it into the APUs. What we said is that will come out in the second half of 2017. It’s far enough that we haven’t released any details of the specific form factors it’s going into, but it’s an APU. You’ll certainly see it beginning with the notebook market. That’s our sweet spot today.



One point on the Zen slides mentioned that you’re optimizing for single-core performance—most workloads that consumers run aren’t heavily multithreaded. Does that mean you’re going to adopt a higher clock speed or “turbo boost” strategy with Zen?

Well, interesting. What you’re seeing with Zen is its versatility. What is Cinebench trying to represent, or the benchmark that we showed? They show off—we show off a number of multithreaded applications. And you saw that we’ve done a true simultaneous multithreaded implementation. That really helps double the effective cores for those applications.

But we did it—and I mentioned this in the presentation—by increasing the resources in that execution pipeline. So if you are running single-thread, you get the benefit of these additional resources. It’s a versatile core; it’s going to play well to single-threaded

and multithreaded applications.

The AM4 socket will support both your APUs as well as Summit Ridge?

Correct. This will not be a new socket.

You've mentioned that you've proven the 14nm FinFET technology out on your Polaris GPU. Can you give us an idea what the manufacturing yields have been for Polaris, whether they've met demand, and what we might expect for Zen?

We've had great demand for Polaris. We met our build expectations and then turned out and sold out after that with Polaris. That ramp is in full flight, and what I'll tell you is that 14nm is meeting our expectations, and our plans, and I can tell you that we expect it to do the same for this SoC as it ramps into the Summit Ridge and Naples products.

You have a joint venture in China, sharing x86 technology for server SoCs. Will you be sharing the Zen Naples technology with them as well?

We didn't share the specifics of that agreement, but it is a joint venture, targeting server.

And does your IP relationship with Intel allow for this?

There is no impediment on the joint venture that we formed.

Hitting a 40 percent improvement in instructions per clock is like throwing a football two miles. Did you really achieve that?

We did it. We've demonstrated it. We just went public with it at the [May 2015] analyst day. That target was actually set at design launch.

Custom microprocessor designs are long and arduous. And the triple constraints of what I shared—performance, throughput, and power efficiency—they play against each other. It's very hard, in fact, to achieve all three. But that's what the team pulled off. It's just a maniacal execution by the team.

And the triple constraints of what I shared—performance, throughput, and power efficiency—they play against each other. It's very hard, in fact, to achieve all three. But that's what the team pulled off.

I've just seen so many products whose performance targets are announced, and upon release, it's like, whoa.

The industry is littered with missed microprocessor targets.

You're discussing this at the Hot Chips conference, and one of the questions that's always asked is the size of the die and the transistor count. What are they?

We're not releasing the transistor count.

In the last few years, it seems like AMD has become more of a semi-custom company, with the APUs you've supplied for the game consoles really helping keep AMD afloat. With Zen, do you expect to return to a more PC-specific focus?

We've actually been clear—our business objective is a mix. No change in that strategy. Now the arsenal is strengthened. We can go after that high-performance desktop. We can re-enter that x86 server market. That's growth on our AMD product side. Now that new CPU—that Zen core and our rejuvenated graphics roadmap, those are IPs, those are arsenals that can be tapped into future semi-custom.

But it does also go back to your comment—how did you achieve 40 percent improvement, how did you pull it off? We are one of the very few companies that understands how to put together leading-edge, high-performance chip designs. And that's why we've been successful in the semi-custom industry. You have to have the IP, and you have to know how to put together and deliver high-performance design.

That's what we have at AMD.

Go back through AMD's history of chip designs: the K6, the Athlon, and others. Do you think this eclipses those?

Well, that's why I showed the historic perspective. We absolutely believe that this will be an historic inflection point, as were those you referenced.

Our foot is not coming off the gas pedal, and we're hard at work on next-generation designs.

Was the Zen+ reference today a formal code name, or just indicative of future products?

Not a formal name, just the next generations that the design teams are hard at [work].

With Zen, you told the team that you wanted a 40 percent improvement in IPC, but with the same power as the Excavator core. Do you have similar marching orders for these forthcoming Zen cores?

We have leapfrog design teams, so we didn't wait for Zen to be completed to start the next generation. They're hard at it. Of course we're not putting out any specifics, but every generation will face the same task that the Zen team faced: how do you drive performance, how do you drive throughput, how do you drive efficiency? That triple objective will not change, going forward in our roadmap.

With Naples, can we assume you have a four-way processor planned?

We've shared today Summit Ridge, and then the 2P configuration on Naples.

Your rival Intel has spent the entire week talking about sensors, embedded, and the Internet of Things. You've listed *embedded* as a market for Zen. Does this mean that Zen has an IoT future?

Many of the IoT devices that are leveraging sensors are taking...at any point around you they're gathering information. They need to be very efficient, and they need to be low cost, because you need a plethora of them.

IoT for us answers a question: What do you do with all that data that those sensors are creating? IoT...creates a massive, massive amount of data, and you'll need a hub to collect that, an edge of network, and then an expanded server and cloud capability to run those IoT devices. That's what we're targeting, with what we shared today.

The last time AMD represented a threat to Intel was with Athlon, and I remember that it was hard to get motherboards. There just weren't a lot of them made. There were rumors of threats from Intel. Do you expect anything similar this time? That's one way to slow you down.

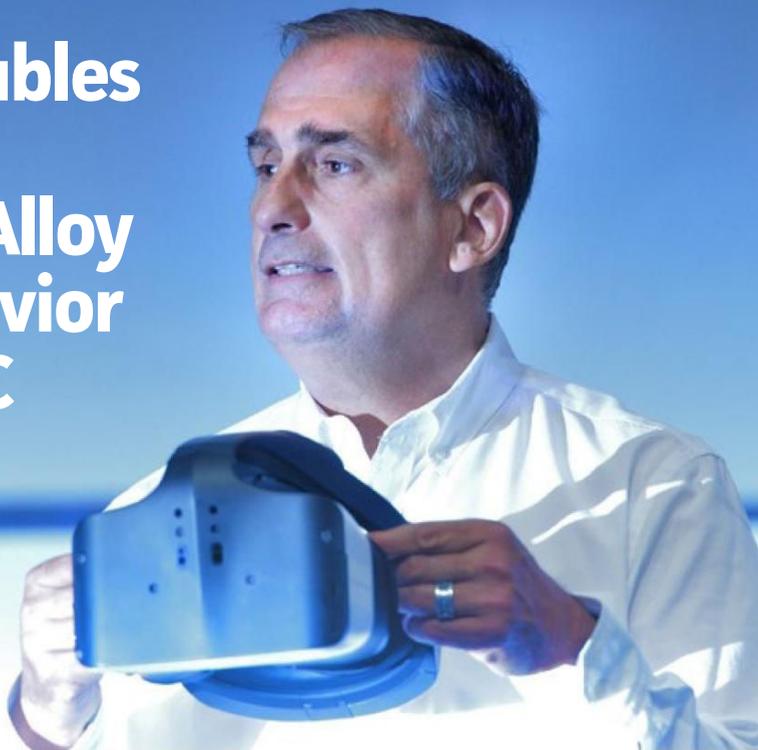
I can tell you that there is tremendous excitement and pull from the market for the Zen core. Great interaction for these products, with our customers. Markets want competition; it's that simple.

Lisa Su used the phrase "the best is yet to come" to describe the future of AMD. What's the sentiment within your organization, the engineers who are making these products? Do they believe that they can offer true competition to Intel's products, and not just a cheaper alternative as they did during AMD's darker years?

The engineers at AMD are incredibly excited and they're incredibly proud. Again, they've been at this for years. They've seen that there's been doubters out there as to our ability to deliver, and to come back in this industry. They've kept their heads down; they've been focused, they've delivered. It's a proud moment when they see their handiwork come to fruition, delivering on the design objectives they set years ago. And they know AMD is one of only a couple companies in the industry that can deliver this kind of high-performance CPU to the market. 📌

Intel doubles down on Project Alloy as the savior of the PC

BY MARK HACHMAN



YOUR PC IS bored. Your smartphone is, too. While you're reading this story, your digital device is twiddling its thumbs, waiting for you to *do* something. When a smartphone can offer enough computing power for most tasks without breaking a sweat, you can understand why PC sales are tanking—and why Intel's so enamored with virtual reality.

Intel announced the Project Alloy (go.pcworld.com/projectalloy) virtual-reality headset last month at its Intel Developer Forum, as well as the next-generation Kaby Lake (go.pcworld.com/kabylake) microprocessor. Kaby Lake PCs are scheduled to ship in the fall. Intel executives positioned both announcements in the context of VR: Alloy for consuming VR content, and Kaby Lake for producing it.

Pinning the PC's hopes upon VR

A few months ago, Intel executives began promoting virtual reality as the leading edge (go.pcworld.com/vrpchw) of the PC, especially VR headsets like the Oculus Rift that depend on the PC for their processing power. "Virtual reality is very computationally intensive, and if Intel can create a requirement for more computationally intensive applications, then guess what? That works for them," said Nathan Brookwood, principal at Insight64, a microprocessor analyst firm.

Intel expects the worlds of virtual reality (the Oculus Rift) and augmented reality (the HoloLens) will eventually merge. That's what Intel's latest project, Project Alloy embodies: a device that primarily projects a virtual reality environment around the user, but incorporates aspects of augmented reality, too.

Alloy uses a pair of RealSense cameras to "see" physical objects like a user's hand, and project them into the virtual space. "We think this is going to be big," Krzanich said during his IDF keynote. "It's so different than anything else that's out there right now."

Beginning in the middle of 2017, Intel plans to open-source the Alloy hardware, so any of its traditional hardware partners can jump on the Alloy bandwagon. Alloy runs on Windows Holographic, the Microsoft operating system that powers its HoloLens. Also midway through 2017, Microsoft plans a free upgrade (go.pcworld.com/w10holo) to Windows 10 that will allow Windows Holographic devices to interact with the millions of Windows 10 PCs already in the market.

It's easy to imagine what both Intel and Microsoft hope will happen next: Devices like Project Alloy become the next big thing, selling millions of PCs with Intel microprocessors and Windows 10 licenses. Alloy and its cousins will become PCs you can strap to your face.

It *almost* sounds like Project Alloy could be Intel's version of the





Microsoft Surface—a game-changing product that could lead the way into an entirely new category of products. But it's still not clear whether Alloy represents a product unto itself, or just a reference design that the company will provide to its partners.

An uncertain future

If this all sounds like a desperate attempt to latch on to the latest trend—well, you're not alone. Unit sales of VR devices aren't expected to take off until 2018 or so, if that, according to Jon Peddie Research. And it's not clear what will drive the technology industry until then.

In fact, we actually have a better idea of what will drive the technology industry *after* VR devices: self-driving cars. BMW executives appeared onstage to reveal their plans to ship cars that allow a driver to take his or her eyes off the road by 2020 or 2021. Also announced recently (but separate from IDF) were Ford's plans to build fully self-driving cars in the same timeframe.

As Insight 64's Brookwood noted, the amount of silicon and intelligence a self-driving car requires vastly outweighs what today's automobiles require. Products that require sophisticated processors

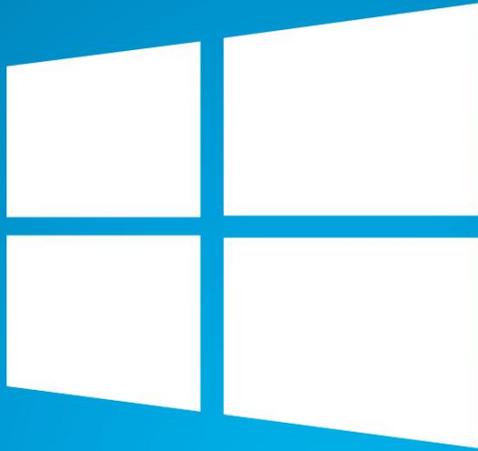


Ford plans to triple its fleet of autonomous research vehicles in 2016, and triple it again in 2017, on its way to mass production of self-driving cars by 2021.

to crunch massive amounts of data provide opportunity to raise Intel's profile once again.

The bottom line, though, is that a self-driving car sells itself. Virtual reality? Merged reality? The jury's still out.

There is hope, though. Kathleen Maher, an analyst with JPR, said the ramifications of virtual reality in the workplace and the home aren't yet fully understood. "It's been a big wake-up call for me, that virtual reality replaces the abstractions we've been using, like pages and text," she said. "That's a really long-term view, but Intel has to be thinking of the long term." 🛑



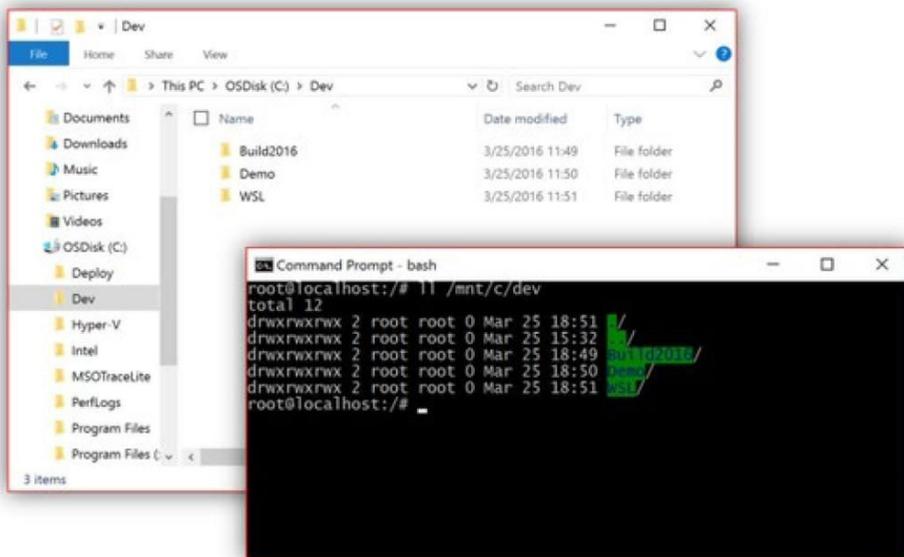
The Windows 10 Anniversary Update's best new features

BY BRAD CHACOS

MICROSOFT'S PLANNING A BIG BASH for Windows 10's first birthday, and you're the one receiving presents. On August 2, the company pushed out the (boringly named) Windows 10 Anniversary Update to Windows 10 PCs, and the update's chock-full of all sorts of new goodies for you to play with—some niche, some helpful, and all free.

Windows Insiders who don't mind living dangerously with unfinished software tested these new features in Windows 10 preview builds for months, and now the Anniversary Update has hit the masses. You'll find our overarching thoughts and impressions in *PCWorld's* Windows 10 Anniversary Update review, but if you want to just cut to the chase and know about the best new goodies right now, this article's for you.

Let's dig in!



Bash shell

This will only appeal to developers, but it shows just how far Microsoft has come in the Satya Nadella era. Microsoft has partnered with Canonical, the organization behind Ubuntu Linux, to bring Linux's beloved Bash shell to Windows 10. Our Bash on Windows 10 deep-dive (go.pcworld.com/w10hhbashshell) reveals how this dark magic works, and there's already encouraging news for this implementation: Linux's most deadly command won't kill your Windows 10 PC (go.pcworld.com/w10bashlinuxok) when you run it in Bash.

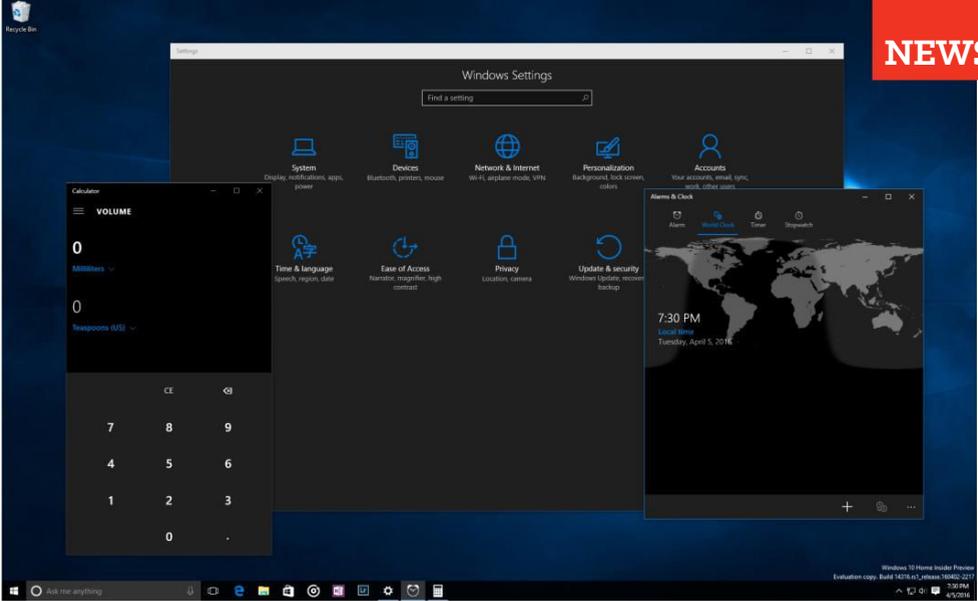
The Bash shell technology is actually powerful enough to run graphical Linux software (go.pcworld.com/w10linuxtrick) and even Ubuntu's full-blown Unity desktop (go.pcworld.com/w10unity) in Windows 10—though it's still severely limited overall (go.pcworld.com/w10unitylimits). Microsoft doesn't want Windows 10 to turn into a Trojan horse for Linux adoption, after all.

Virtual desktop pins

That's not the only update to Windows 10's awesome power-user tools (go.pcworld.com/w10powertools). The virtual desktop feature introduced in the new operating system now lets you pin an open app to all of your virtual desktops—handy if you always want a particular program front-and-center.

To activate the new feature, open the Task View used to manage virtual desktops, right-click on the window you want to pin, then select Show This Window On All Desktops.





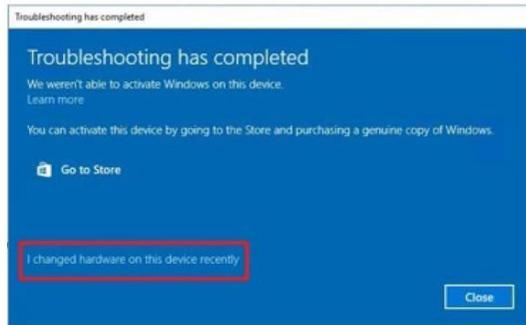
Dark theme

Speaking of desktop tweaks, the Windows 10 Anniversary Update adds a new dark theme for folks who find stock Windows 10 too bright. Hallelujah! Find it at Settings > Personalization > Colors.

Activation Troubleshooter

But if you're more into building PCs than tweaking desktop settings, one new Anniversary Update feature will be an absolute treasure. Windows 10 now allows you to tie your operating system license to your Microsoft account, rather than the specific hardware inside, using a new tool dubbed Activation Troubleshooter (go.pcworld.com/w10activations). That means die-hard system tinkerers should be able to reactivate their license easily, with fewer pesky calls to Microsoft support, in the event of a motherboard and processor upgrade. That sound you just heard was a legion of hard-core DIY PC geeks singing in collective ecstasy.

There's an (undisclosed) limit to how many times you can swap out your hardware with the same license, though, so don't expect to buy a single copy of Windows 10 and use it for life.



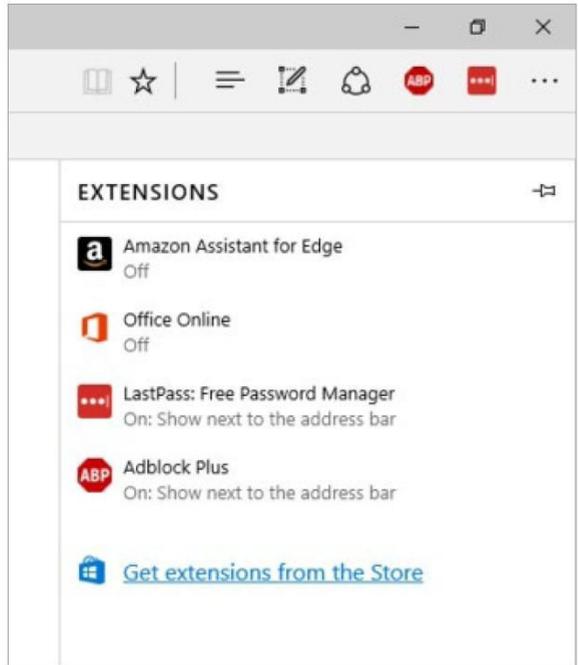
Edge improvements

Let's start digging into new features with more widespread appeal. If you use Windows 10's default Edge browser (go.pcworld.com/w10edge), you'll find some welcome improvements.

First off, Edge is (*finally*) getting extension support. You can install them by clicking the ellipsis menu at Edge's upper right corner, scrolling down to Extensions, and installing them like any other app. The initial wave is limited to 13 separate extensions, with support for add-ons from AdBlock Plus, LastPass, Evernote, Amazon, Office, and a few more.

More interestingly, Cortana now pops up with coupon suggestions when you're web shopping with Edge. Now *that's* handy—as is Edge's newfound ability to sync your bookmarks and more between multiple devices, as long as your Microsoft account is set to sync information across PCs.

Edge is also following Chrome's lead in intelligently auto-pausing (go.pcworld.com/flashedge) "content not central to the webpage." Annoying Flash ads, in other words. That should help you squeeze more life out of your laptop or tablet battery. Huzzah!



Groove Music Pass

Microsoft
Subscription for Groove Music

Groove Music Pass lets you instantly stream and download more music than you can imagine on your favorite devices.

Listen without ads, make perfect playlists, and let artist radio serve you something new. Give us a month, and we'll give you music that rocks your world — all for free while you try the pass. You can cancel at any time.

You've already had a free trial with a previous Microsoft music service.

\$9.99/month \$99.90/year

Meet our heavy hitting catalog

No Internet? No problem.

Windows Security

Making sure it's you

We need to verify your identity for

😊

Hello, Mark Hachman!
Select OK to continue.

More choices

OK Cancel

Windows Hello says hello to apps and websites

Windows Hello biometric authentication support is moving beyond the login screen to Windows Store apps in the Anniversary Update. That means that if you have hardware to support it—and software that supports Windows Hello—you'll be able to sign in to apps with your face or the swipe of a finger.

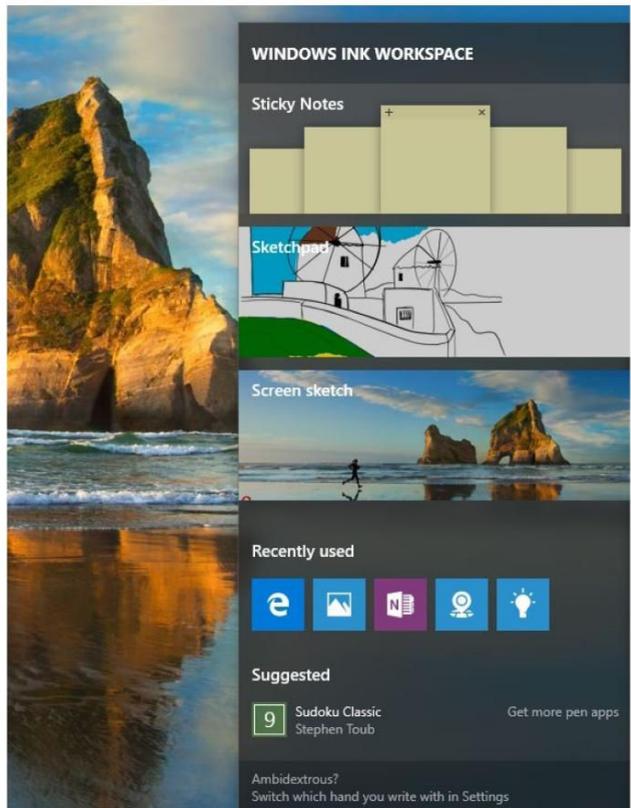
The ability to sign in to websites using Windows Hello in the Edge browser was an anticipated Anniversary Update feature, but it ran into some road bumps. Microsoft officials say biometric authentication for websites will be supported in Edge once the FIDO 2.0 standard officially rolls out in a few months.

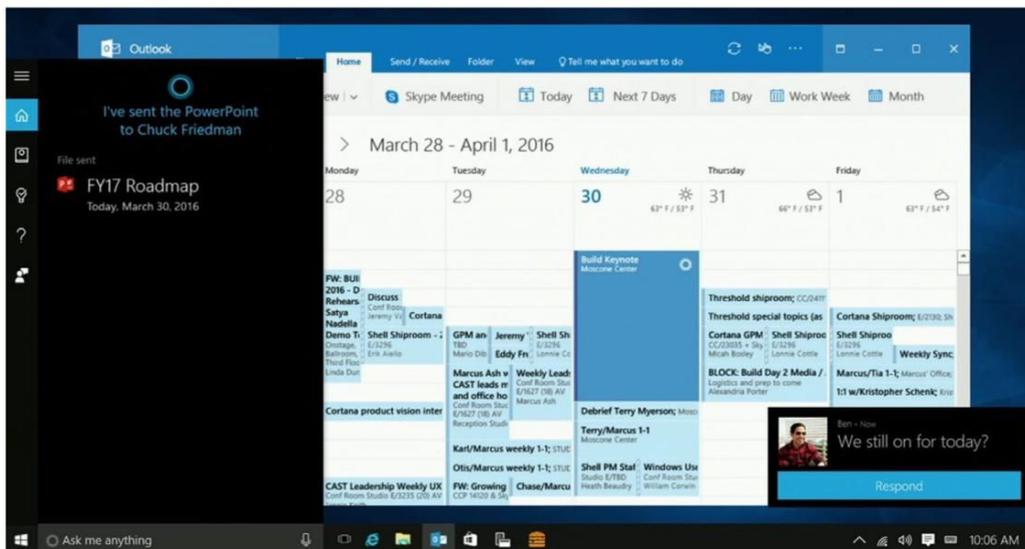
Windows Ink

Playing to its productivity strengths, Microsoft bakes numerous inking improvements into the Windows 10 Anniversary Update. You can pull up a dedicated Ink Workspace (pictured) with tools and apps that support styli, and auto-create Cortana reminders based on written notes, for example. The operating system also includes a “digital ruler” that you can slap onscreen to ensure your digital scribbles line up straight.

It sounds nifty, but two of the three dedicated inking apps—Sticky Notes and Sketchpad—feel lackluster and like they’d be better as a single app. Screen Sketch’s ability to quickly grab a screenshot, mark it up, and share it online is handy, though. Microsoft’s also collected a slew of ink-enabled apps in a dedicated section of the Windows Store, which is a useful touch.

The anticipated ability to draw a line between two points and annotate stops in between in Maps wasn’t quite ready for the Anniversary Update’s launch, however.





Cortana gets smarter

Cortana receives a barrage of beneficial upgrades, too, becoming more proactive (go.pcworld.com/contextualaware) and powerful as Microsoft grants her greater access to the Office, Outlook, and Calendar apps.

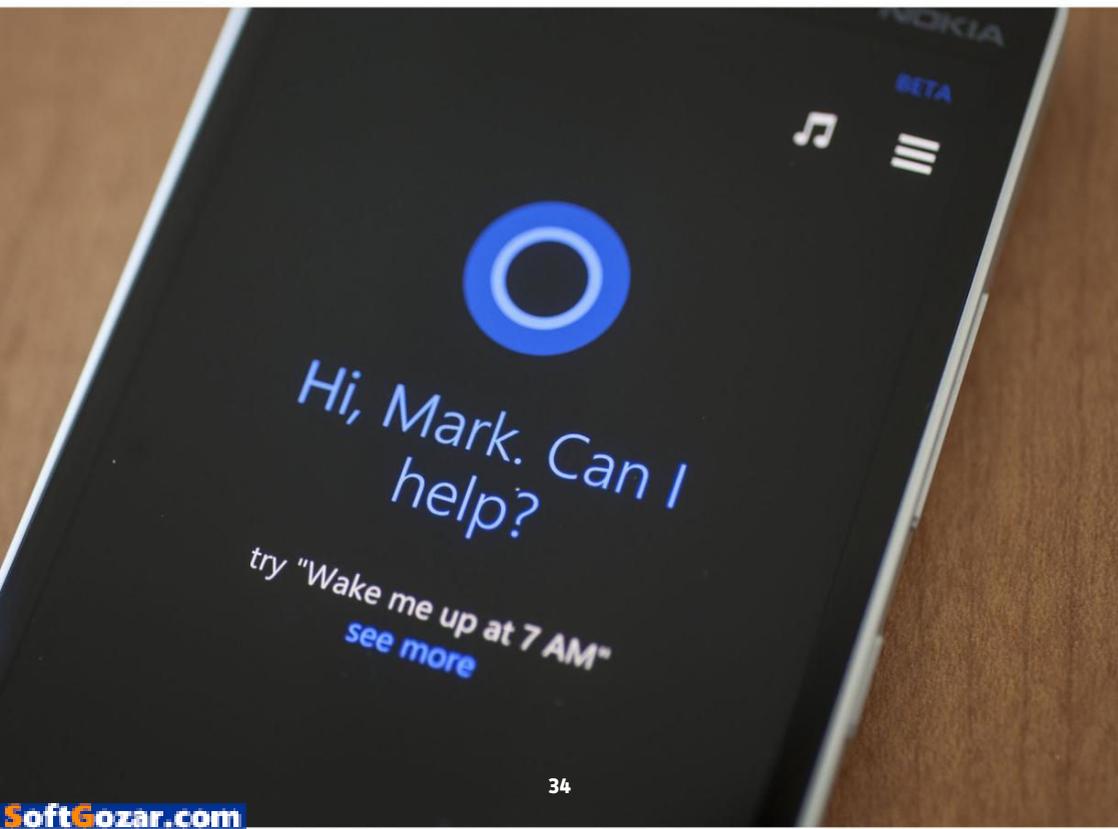
That sort of contextual awareness lets you use commands like “Send Chuck the PowerPoint that I worked on last night” or “What toy store did I visit during last years’ Build conference?” and Cortana actually understands what you mean. You can see that enhanced awareness in Cortana’s coupon suggestions in Edge, too. Cortana can also sniff out flight times and other crucial data in your correspondence in order to create reminders, or allow you to create custom reminders for random facts you need to pull up at any time, like “What was my hotel room number again?”

Cortana’s also accessible from the lock screen now, letting you see your schedule at a glance (or add to it with a voice command). Developers can bake Cortana into third-party apps. But there is some potentially bad news: In the Anniversary Update, you can no longer disable Cortana completely (see story on [page 69](#)).

Cortana loves phones

The new and improved Cortana also gains closer ties to Windows 10 Mobile phones, Android phones, and iPhones with Microsoft's Cortana app installed.

The digital assistant is able to pull notifications and low-battery warnings from your phone and beam them to your PC, reducing the need to pull your phone out of your pocket—and the threat of a dead device at the end of the day. And that's not all; you can receive your Android or Windows 10 Mobile phone's notifications on your Windows PC. The communication goes both ways, too, as you can respond to texts via Cortana or pull up Maps directions on your PC and push them over to your phone. Handy stuff.





Start menu overhaul

Microsoft slightly reimagined the Windows 10 Start menu in the Anniversary Update. The original version displayed your most-used and recently added apps, with various settings (power, system settings, etc.) at the bottom of the menu. Digging through all your apps required clicking a discrete All Apps button.

The Anniversary Update relegates those various power and settings options to icon status in a newfound left-hand rail, and the Start menu now displays all of your installed apps underneath the most-used and recently added ones in the main list. It's a small change, but a welcome one. Unfortunately for folks who dislike ads cluttering up their operating system, the new Start menu was rife with "suggested apps" in our review copy of the OS.

The Connect app

There are some fresh apps in the Anniversary Update, too. The new Connect app lets you wirelessly connect your phone to a PC using Windows 10 Mobile's killer Continuum feature, no docks or Miracast adapters necessary. Your phone's Continuum desktop simply runs inside a window on the other PC, as seen below.

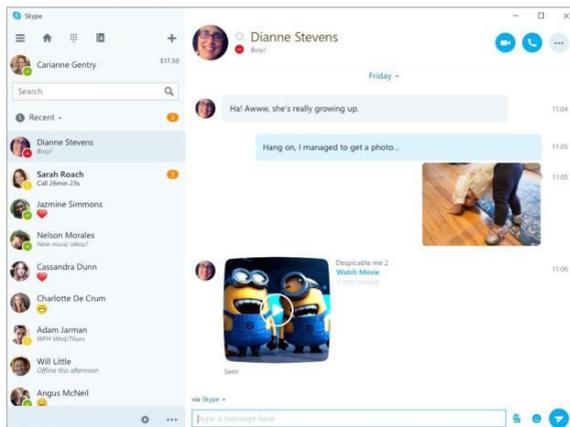
And if you're using a Windows 10 PC capable of casting Miracast signals, you can use the Connect app to beam its display to other Windows 10 PCs—again with no docks or adapters on the receiving device—which could be supremely handy when it's time to make a presentation. Connect feels a bit niche, but hey, a new feature's a new feature.



Universal Skype app

Skype rolled out a new Universal Windows Platform (UWP) app for the service, and the Skype Preview is baked into the Anniversary Update after being snubbed in Windows 10. It's pretty simple and effective, complete with support for those fancy chatbots (go.pcworld.com/chatbots) Microsoft's been banging on about.

Not all features are included quite yet, though—you can't use real-time translation, for instance. On the plus side, you'll receive notifications for incoming messages and calls regardless of whether the app is actually open, which itself is a huge step up over the old-school desktop version.



Xbox Play Anywhere

Universal apps are the secret sauce in one of the Anniversary Update's highlight new features: Xbox Play Anywhere (go.pcworld.com/xboxplayanyw). This awesome feature from Microsoft lets you buy a game once and play it on Windows 10 and the Xbox One console alike, complete with cross-platform multiplayer and cloud-based saves that travel with you from device to device.

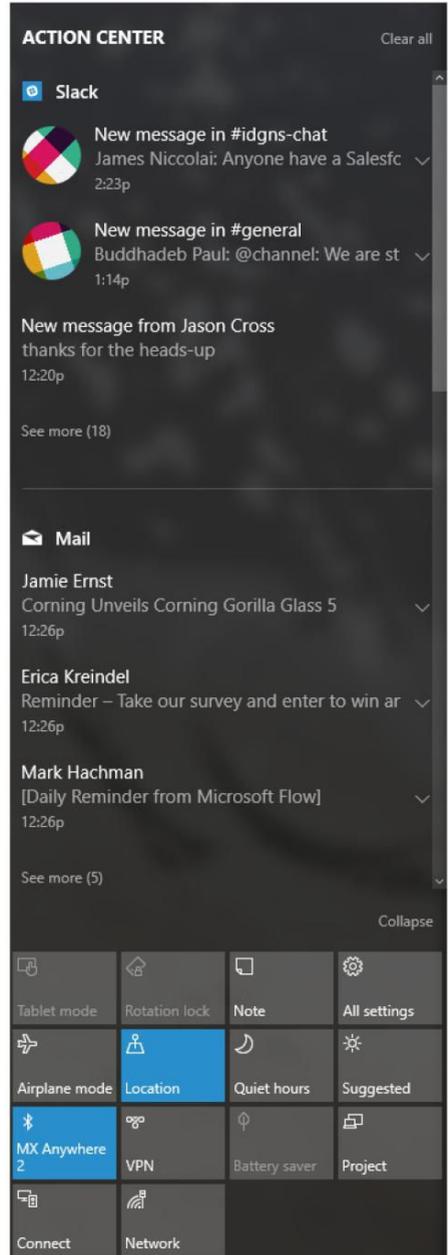
A slew of Microsoft Studios games will be Xbox Play Anywhere-enabled in the coming months, from *Gears of War 4* to *Forza Horizon* to *Sea of Thieves*, aka the most interesting game at E3 2016. Look for the first Play Anywhere games to land in September. Here's hoping the PC versions are more like the superb *Forza Horizon* and less like the rushed (read: buggy and meh) *Quantum Horizon* and *Gears of War: Ultimate Edition* ports.

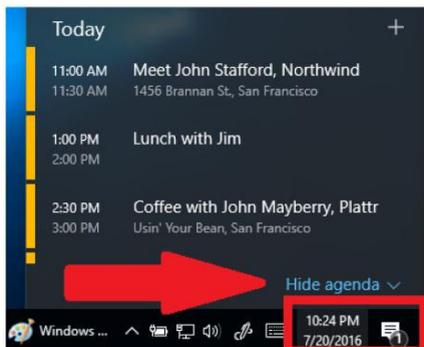


Action Center tweaks

Microsoft's showering the Action Center—Windows 10's notifications hub (go.pcworld.com/w10ac)—with some love, too. You can set priority levels for individual apps, so that notifications you care about most appear at the top of your Action Center feed. You can also set limits for how many notifications a given app can spit out into Action Center, with the default set to three. If you receive more than three notifications, older ones are hidden to surface notifications from other apps, too, so one popular app no longer dominates your Action Center. It's a lot more useful than the original design, and much more visually appealing, too.

The Action Center's icon in the taskbar also displays a badge showing how many unread notifications are awaiting your attention...





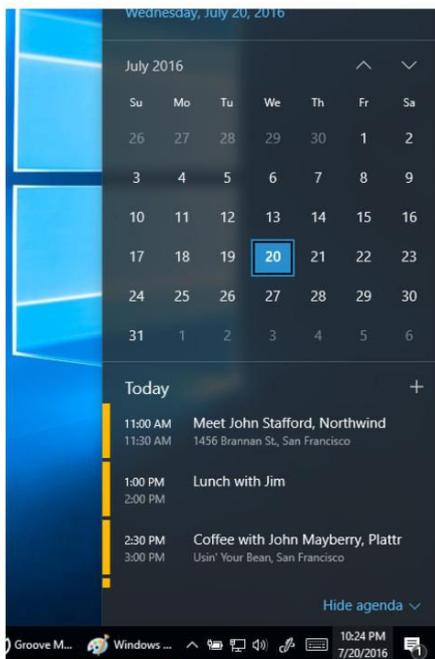
Taskbar notification icons

...but it's not the only one. Any universal Windows app pinned to your taskbar also displays notification badges showing how many unattended tasks wait for you inside.

The taskbar calendar gets useful

The taskbar calendar found in Windows 10's taskbar received a much-appreciated overhaul in the Anniversary Update, too. Before, it was a basic calendar. Now, it ties into the main Calendar app, and clicking on the time/date in your taskbar brings up a calendar view complete with an overview of your tasks for the day. Awesome!

Also awesome: The time and date now shows up in your taskbar on every connected display in the Anniversary Update, not just your main display. That makes you wonder why that wasn't possible before, but *c'est la vie*.




OneNote 51.0%
 Managed by Windows
 In use: 51.0% Background: 0.0%
 Always allowed in background
 Managed by Windows
 Never allowed in background

Battery tweaks and tools

The Settings menu formerly known as Battery Saver is henceforth classified as merely Battery, with all battery-related settings corralled within. Relatedly, the granular per-app settings for when individual Windows Store apps are running in the background now include a Managed By Windows option in addition to the black-and-white Always Allowed In Background and Never Allowed In Background choices available.

Here’s how Microsoft describes it: “With this option, not only will the app stop running in the background when Battery Saver is enabled, but it will temporarily turn off apps with high battery drain that you haven’t used in a while or pinned to your Start screen, till you next launch the application.”

New emoji!





But wait, there's more!

The Windows 10 Anniversary Update comes with other little alterations and fine-tuning as well. The Windows installation screen contains more information than before, for example, and you can comment in the Feedback Hub and tell Windows not to install updates during specific hours.

All these new features are just the tip of the iceberg, though. For even more handy tweaks and secrets, be sure to check out *PCWorld's* look at the Anniversary Update's hidden secrets (go.pcworld.com/w10annsecrets), or our massive roundup of Windows 10's best tips and tricks (go.pcworld.com/w10tips). 

What Microsoft takes away from Windows 10 in the Anniversary Update

BY IAN PAUL

THE WINDOWS 10 ANNIVERSARY UPDATE is full of great new features like a more powerful Cortana, deeper integration with mobile devices, and new inking features designed to make the stylus cool again. But as with any new version of Windows, the Anniversary Update also removes a few features and functionality that some of you might miss.

Amid all the excitement over what's coming to AU, here's a look at what Microsoft sent to the Recycle Bin.



The impersonal login page

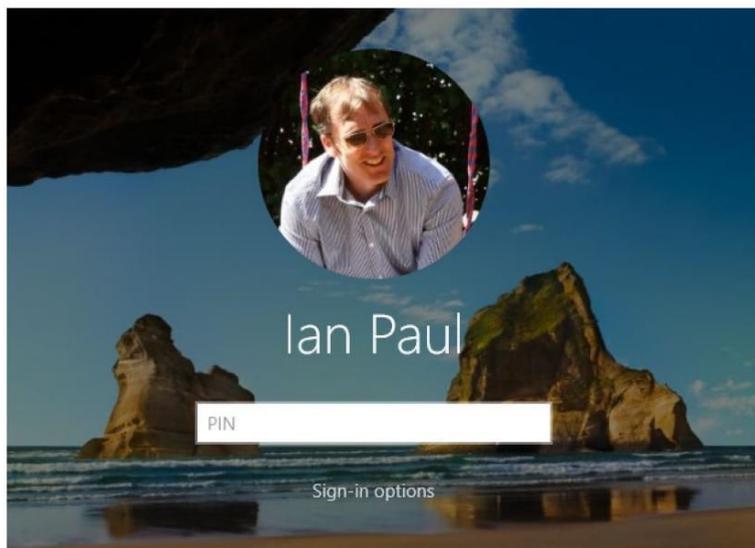
A small, but nice, cosmetic change—now, when you click or swipe away the lock screen background picture, you don't end up on a login screen with a plain colored background or the default Windows background. Instead, you get the same picture as your lock screen by default.

The new animation for switching between the lock screen and login page is quite nice too.

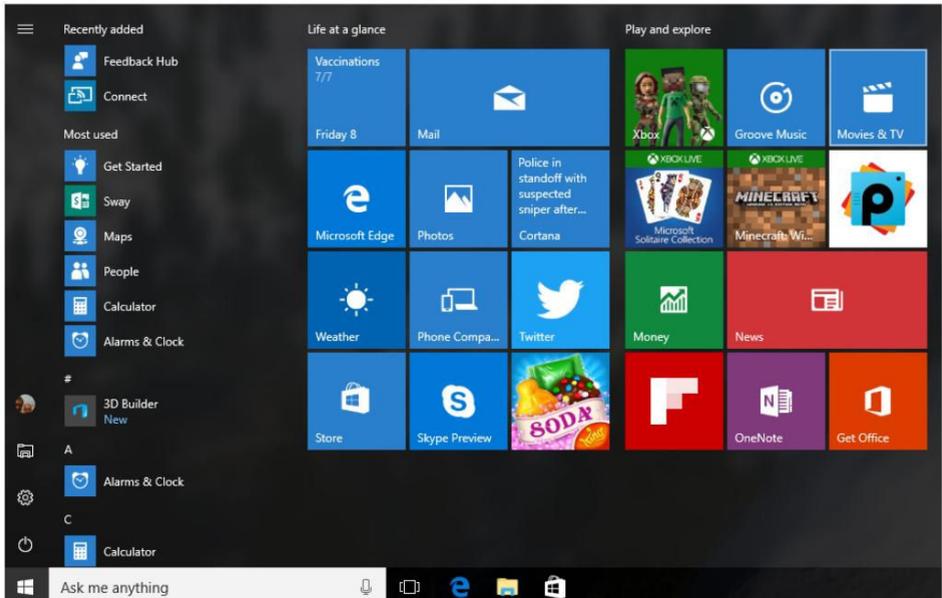
Wi-Fi Sense

Microsoft's experiment with seamless Wi-Fi login sharing is going away. Wi-Fi Sense (go.pcworld.com/w10wifisense) was originally a feature on Windows phones, and it came to PCs with Windows 10 in 2015. Now, Microsoft says it is removing the feature from both phones and PCs beginning with the Anniversary Update, because so few people used it.

While a nice idea in theory, Wi-Fi Sense was never welcomed by users and critics largely because it required Microsoft to store your Wi-Fi login credentials on its servers. Some of those fears were misplaced,



The Windows 10 login page in build 14385.



but the general idea of the service was never well received.

While the Wi-Fi login sharing went away, Wi-Fi Sense's secondary feature, which alerts you when an open Wi-Fi network is nearby, remains.

Kid's Corner

Windows 10 Mobile's kids-only space, Kid's Corner, is another victim of low usage. The feature first came to Windows handsets with Windows Phone 8.1. It was designed as a way to create a kid-friendly area on Windows phones—complete with its own Start screen—where kids could use certain apps and other data without accessing other parts of the phone.

While Kid's Corner is gone, there is an alternative feature that users can try instead called Apps Corner. The feature is under Settings > Accounts > Apps Corner. It doesn't have quite the same features that Kid's Corner did, but you can give children their own Start screen and access to select apps.

All apps

A longtime feature of the Start menu has gone away. Starting with the Anniversary Update, Windows 10 users can no longer see the All Apps button, which was also known as All Programs in previous versions of Windows.

Instead, users just see a long list of installed apps in alphabetical order like they do now when they press All Apps. The idea is to reduce clicks to access programs in the Start menu.

To accommodate the end of All Apps, Microsoft put certain features to the left of the installed apps scroll such as the Settings app, your user account picture, and the power button.

Messaging Everywhere

Okay, fair enough, this isn't something that Microsoft took away since it never made it to the standard build of Windows 10 in the first place. Nevertheless, many Windows 10 Mobile users were looking forward to the ability to use the Messaging app on both their PCs and phones to send and receive texts.

Instead, Microsoft decided to rebuild the feature for Skype (go.pcworld.com/w10text2skype).

Let's hope Microsoft gets it right, as Skype integration is pathetically broken and missing key features on Windows 10 Mobile at this writing.

In the meantime, Windows 10 Mobile users will have to make do with Cortana's SMS (go.pcworld.com/cortanasms) feature for sending texts on their PCs.

Let's hope Microsoft gets it right, as Skype integration is pathetically broken and missing key features on Windows 10 Mobile at this writing.

You'll use Cortana and you'll like it

Microsoft is playing hardball when it comes to Cortana. In previous builds of Windows 10, if you didn't like Cortana you could opt to use a plain vanilla search option instead. But with the Anniversary Update

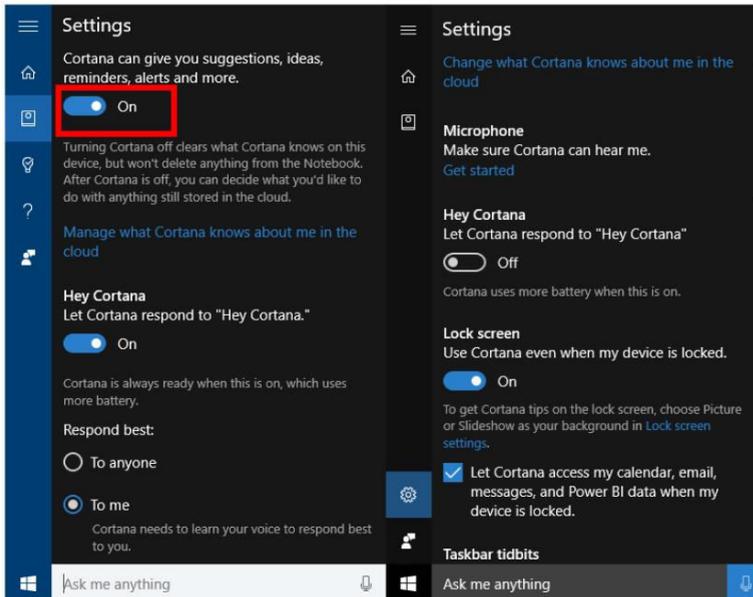
the option to turn off Cortana and only use search is gone.

Microsoft confirmed to *PCWorld* that the plain search option is gone and that Cortana is your only choice. If you don't like that, Microsoft points out you can remove the Cortana text-entry box from the taskbar. We've also got a few tips ([page 69](#)) for anyone who wants to keep Cortana, but limit how much information it can assimilate about you.

Nevertheless, making Cortana mandatory is an aggressive move by Microsoft, and it likely won't sit well with the more privacy-conscious users—at least those who haven't already switched to Linux.

The Get Windows 10 app

We saved the best for last. Windows 10's feature removal isn't just for Windows 10 PCs. Windows 7 and Windows 8.1 users get a treat as well. With the Anniversary Update that landed August 2 and the free upgrade period having expired, Windows 10 holdouts will soon stop seeing notification pop-ups and full-screen nags asking them to upgrade. Congratulations, Windows rebels. You made it. 📴



Windows 10
November update (left)
vs. Cortana
Insider build
14383 (right).

TAKE

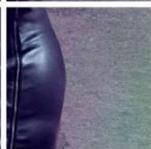


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STAND



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Inside the PocketCHIP, a \$49 Portable Linux Computer

BY BENJ EDWARDS

SINCE THE LAUNCH of the Raspberry Pi in 2012, the hobbyist community centered on low-cost, open-source, ARM-based computers has exploded dramatically. Every year, these small, hackable devices get cheaper and more powerful. In 2015, Oakland-based Next Thing Co. upped the ante by successfully Kickstarting a \$9 computer it called CHIP to the tune of \$2 million in funding. As part of its pitch, Next Thing Co. also showcased the PocketCHIP (go.pcworld.com/pocketchip), a handheld version of the CHIP with a built-in keyboard and touchscreen display.

The PocketCHIP includes a 1GHz ARM CPU (with a Mali 400 GPU), 4GB of flash storage, 512MB of RAM, Wi-Fi, Bluetooth, a 4.3-inch touchscreen display, a primitive keyboard, and a five-hour LiPo battery. With this device now shipping to Kickstarter backers, I thought it would be helpful to take a closer look at the gadget on my trusty workbench and document my findings.

Bigger than an old Game Boy

The first thing I thought of when I saw the PocketCHIP was “Game Boy,” and I think the similarity to Nintendo’s famous handheld is intentional. The height and depth of the PocketCHIP’s plastic case almost exactly matches that of the 1989 Game Boy, with only the width being off (the PocketCHIP is wider).

That brings me to an important point: “PocketCHIP” is almost a misnomer. At 6.4 x 4.4 x 1.125 inches (HxWxD), this device is almost too large to fit into any pocket I own. If I did manage to stuff it into a large pocket, I’d be afraid it would split if I sat down. In other words, it’s pretty huge compared to most modern pocket-sized devices.





The backside

Here we see the CHIP module (left) detached from the “console”—it plugs in via two double-rowed pin headers on the circuit board. The CHIP is the heart of the console—it’s the computer that makes it all possible. The CHIP itself has three ports: a Micro USB port for 5V power, a regular female USB-A host port for accessories, and a 1/8-inch combo AV phono jack that can be used for headphones or, with a special cable, to output both composite video and sound. HDMI and VGA breakout boards are available for the CHIP separately, but they won’t work with the Pocketchip circuit board plugged in.

Pocketchip’s smooth, angular plastic case feels fairly comfortable in your hands as you cradle it to type. Its translucent peek-a-boo nature is an enticing feature in a device that you can take apart, which you’ll see next.

PocketCHIP apart

In keeping with its spirit of hackability, the PocketCHIP is easy to disassemble into its constituent parts—if you ever wanted to do such a thing.

PocketCHIP is composed of five main parts: the aforementioned CHIP board, which is the same as you would buy for \$9 separately; a five-hour LiPo battery; a 480x272 backlit LCD; the plastic housing (including LCD bezel); and a white circuit board that holds it all together, which includes a keyboard (we'll take a closer look at that in a minute).

If you're coming from a Raspberry Pi angle, the PocketCHIP's onboard 4GB storage is a big limitation, but it's also a plus: With the Pi, you need a case, a power supply, an SD card, a display, a keyboard, and a mouse to get going (that often adds up quickly). PocketCHIP has everything you need built into one device, and it's ready to go when you turn it on.





The keyboard up close

The keyboard of the PocketCHIP is as primitive and simple as they come; it consists of 56 metal dome switches—the kind you’d see beneath the plastic keys in a calculator keyboard or some old joysticks. When you push down on one of these dome-shaped pieces of metal, it flexes inward, touches a contact beneath, and completes a circuit, which registers a key press. To protect the metal domes, Next Thing Co. has covered them with a transparent self-adhesive plastic film.

The keyboard works surprisingly well for what it is (and for the price); although I’d expect the domes to wear out over time, and I would definitely not want to type out a term paper on it. The inclusion of a four-way directional control, two start- and select-like buttons, and a dedicated home button at the bottom are very welcome. For \$49, this kind of keyboard is definitely not a deal breaker.

The home screen

Upon turning on the PocketCHIP—or by pressing the dedicated home button on the bottom of the keyboard—you will see this handy home screen. By default, it displays six icons that launch various built-in apps, which we will go into individually in a moment.

It's worth noting that configuring Wi-Fi (as well as adjusting brightness and sound volume) on the PocketCHIP is mercifully easy using a touchscreen interface. Shut-down and restart functions are also only a screen-tap away. At the moment, however, Bluetooth setup requires some deft command-line work.

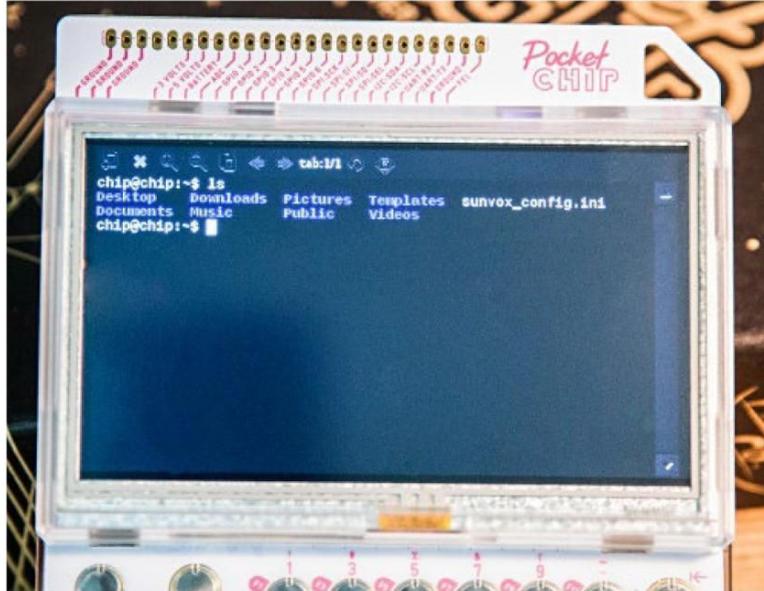
And golly, look at all those general-purpose input/outputs (GPIO) all broken out and nicely arranged at the top of the device (just above the display), just begging to connect motors, sensors, switches, and LEDs. The fact that you could, say, build a robot around the PocketCHIP is a big part of this device's appeal.



The terminal

Here is the Linux console you see when you tap on the Terminal icon. The first thing I did when turning on my PocketCHIP (after setting up Wi-Fi) was update the apt-get repository, install SSH (why it was not included is beyond me), then log in to a remote dedicated webserver that I administer. It was nice to have that power instantly available to me via a typical Linux command-line interface.

It's nice that several core features of the PocketCHIP can be accessed without resorting to the command line, but to do anything interesting on this gadget beyond its few built-in apps, you will have to delve into this text-based netherworld eventually. An iPad this is not. But an iPad (by default) can't run arbitrary code, either.

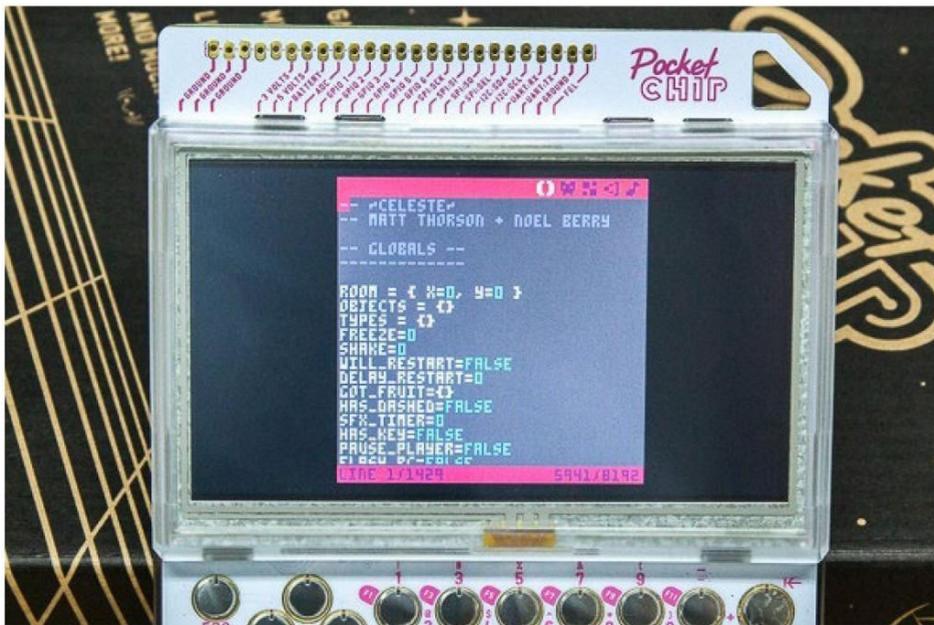


PICO-8 gaming

A big selling point of the PocketCHIP is that it can play thousands of free indie games straight out of the box via PICO-8, which is equal parts virtual game console, programming community, and IDE. PICO-8, as an engine, succeeds for game development novices by virtue of its self-imposed tech limitations. As a result, most PICO-8 games look very much like retro console titles. The PocketCHIP comes with many PICO-8 games preinstalled, and you can download more quickly and easily.

One note on actually playing the games: Do not expect to game intensively on the PocketCHIP's controls. The dome switches, while configured in such a way to facilitate gameplay, leave much to be desired in terms of a control interface. It would be neat if Next Thing Co. released a more console-like attachment for the CHIP with Game Boy-like conductive rubber switches and plastic buttons (maybe some housing too). Of course, you could always hack one up yourself—just the kind of thing the Pocket CHIP was meant for. Or you could probably connect a Bluetooth gamepad with some finagling.





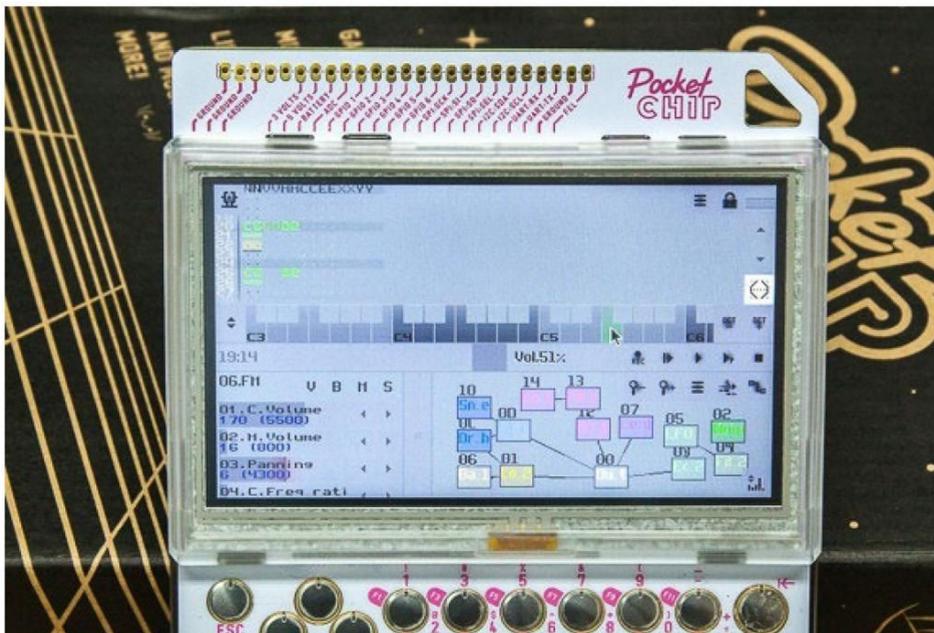
Modifying PICO-8 games

One of the neatest things about PICO-8 games is that you can modify them any way you like, even while you are playing the game. That means you can change the rules or simply extend an existing game in a new way. Here we see the editing screen, which you can use with the PocketCHIP's built-in keyboard to program to your heart's content (or plug in a USB keyboard and do it). Although I would not personally program on the handheld's built-in keyboard, I could see a creative kid with a lot of time on their hands doing it in earnest.

SunVox

When you click on the Make Music home screen icon, it loads SunVox, a multiplatform modular synthesizer with a pattern-based sequencer. It allows you to composite retro-sounding chiptune music on your PocketCHIP.

While it's a neat idea, SunVox's interface is, frankly, incomprehensible, and it's frustrating to navigate using the tiny icons that you have to try to tap on (emulating a mouse). You'd have to want to make music with this thing really badly to take the time to figure it out. I'm a musician with significant sequencer experience and I don't even want to use it. If you're already familiar with SunVox and know what you're doing, its inclusion here may be a plus. Otherwise, it's definitely not a selling point of this product.



Text editor

No portable device would be complete without a quick way to take notes (or perhaps quickly hack out some C), so when you click on the Write button on the PocketCHIP's home screen, the gadget loads up a simple, white-on-black text editor. It's bare-bones but functional, and I think it's a nice inclusion to the PocketCHIP suite of apps.

It's worth noting that I skipped over showing the PocketCHIP's built-in Help function (accessible via a home screen icon), which presents a nice illustrated introduction to using the PocketCHIP itself. It's definitely a big plus.



File manager

Last but not least, we have PocketCHIP's built-in GUI-based file manager, which is accessible via the Browse Files icon on the home screen. Here, using the touchscreen as an emulated mouse, you can graphically delve into the file system lurking behind the PocketCHIP's kindly interface. While the interface is a little awkward to navigate using touch (I did not want to use it for very long), it's a boon for Linux command-line novices, and a handy tool for file management on the device.



A worthy gadget for starter hobbyists

When you put all the features of the PocketCHIP together, and weigh it against its currently advertised \$49 price, it's clear that Next Thing Co. has a winner on its hands. The firm hints that it may later raise the price to \$69 after an introductory period, but considering its bare-bones design, I think that would be a mistake. While \$69 for something like this five years ago would have been insanely cheap, computing power per-dollar, per-watt is dropping like a rock.

PocketCHIP wins big on usability: This is obviously not intended to be a consumer device for the masses, but it is still incredibly easy to use considering its hackable pedigree. To that end, this machine could form the basis of a killer middle- or high-school class on embedded systems engineering. Think of it as the ultimate “bright kid” present—a low-cost all-in-one starting point to a much wider world of creative exploration in electronics and computers. Those are powerful qualities to have in a \$49 general-purpose computing device that comes with no strings attached. 🔌



Of all the things Shea's dog is trained to do, the most important is opening doors.

A rare muscle disease keeps Shea confined to a wheelchair. But thanks to her best friend Mercer, she's not confined *by* it. Mercer is at Shea's side 24 hours a day to help her do all sorts of things on her own, from picking things up off the floor to opening the refrigerator and turning on the lights. How inseparable are Shea and Mercer? Take a look in her school yearbook and you'll find his picture right there next to hers.

For more than 30 years, Canine Companions for Independence has been teaming people like Shea with dogs like Mercer completely free of charge. To find out more about making a donation, volunteering, or applying for a dog of your own, visit www.cci.org or call 1-800-572-BARK.



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**CONSUMER
WATCH**



Hello, Mark

Bing Rewards is becoming Microsoft Rewards

Microsoft Rewards is how Microsoft will pay you to use Edge, Bing, and more

Bing Rewards morphs into something much bigger.

BY MARK HACHMAN

YEARS BACK, MICROSOFT began paying people to use its Bing search service via a program called Bing Rewards. Now, Microsoft will do the same with its Edge browser and other products.

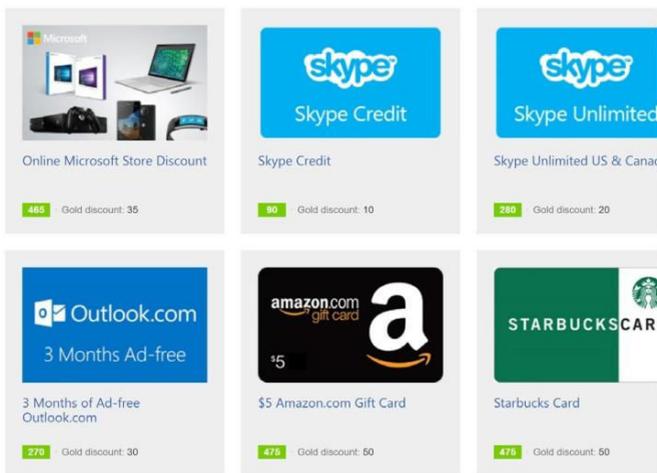
Microsoft announced recently that over the next few weeks, Bing Rewards (bing.com/rewards) will become Microsoft Rewards. The concept remains the same: The more you use or buy Microsoft products, the more freebies you'll receive in return. With the debut of Microsoft Rewards, you'll also be able to accrue points by browsing with Edge or purchasing items at brick-and-mortar Microsoft Stores.

Why this matters: At the end of July, Google Chrome held over 50 percent of the world's browser market share; Edge is at 5.09 percent, according to NetApplications. Microsoft clearly wants to lift that number. Locking down Cortana to use only Bing (go.pcworld.com/cortanaedge)

might be seen as the stick, but a rewards program like Microsoft Rewards is the carrot.

What will change with Microsoft Rewards

With Bing Rewards, you'd receive a Bing Rewards credit for every two Bing searches you performed per day (up to roughly 30 or so on your PC, and an additional 20 on a mobile phone). Those can add up fast: 475 credits earns you a \$5 discount at Amazon.com, for example, or a Starbucks gift card. Under the new Microsoft Rewards program, the number of times you can search Bing for credit will remain the same, for now.



Some of the existing Bing Rewards discounts.

Under the new system, Bing Rewards credits will be replaced by Microsoft Points. Each Bing Rewards credit will automatically be swapped for 10 Microsoft Points, Microsoft said. (Unfortunately, this is an entirely separate program from Microsoft's Xbox Rewards program, which also offers credits and its own discounts.)

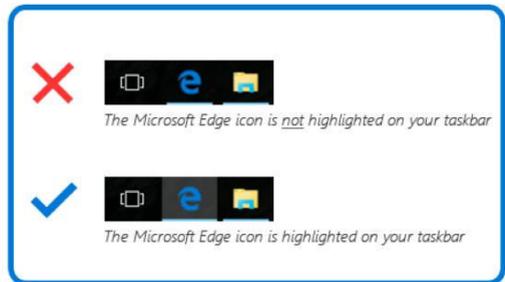
Now, however, Microsoft says you'll *also* earn points for shopping at the physical Microsoft stores; buying movies, music, and more via the Windows 10 Store app; as well as browsing with Edge. Microsoft is also maintaining its tier system, so you'll earn additional discounts once you reach a certain number of points. The only difference is that those discounts will now apply exclusively to Microsoft products.

You'll earn points for every hour (yes, hour) you use Edge, up to 30 hours per month.

How Microsoft Rewards with Edge will work

Remember how Edge has evolved: When Windows 10 shipped, it was the weakest link. A year later, Edge has substantially improved, especially with its new extensions. But the only way to spur some users to try it is to pay them to use it.

And use it you must. Microsoft's "browse and earn" (go.pcworld.com/rewardsbrowse) portion of Bing Rewards credits you only you if you're actively using Edge: The browser's icon must be highlighted on your taskbar (showing you're actively using it), and Microsoft wants you to be "actively engaging with the browser"—in other words, performing "mouse movements, clicks, touch gestures, [and] keyboard presses" or watching a full-screen movie.



To take advantage of the new Microsoft Rewards points for browsing with Microsoft Edge, you have the browser open, like this.

You'll earn points for every hour (yes, hour) you use Edge, up to 30 hours per month, Microsoft said. The company did not reveal how many points an hour of browsing with Edge would earn, however.

You'll also earn points by buying, say, a new Surface at the Microsoft Store, at one point per dollar spent up to \$20,000 total. Just be sure to provide your email address when the cashier asks; it's the only way you'll be able to apply the new Microsoft Points to your account. 



Microsoft faces two new lawsuits over aggressive Windows 10 upgrade tactics

BY IAN PAUL

MICROSOFT IS FACING two more lawsuits over the company's questionable Windows 10 upgrade tactics. Both suits are seeking class-action status.

The first suit was filed in U.S. District Court in Florida. It alleges that Microsoft's Windows 10 upgrade prompts "violated laws governing unsolicited electronic advertisements," as reported by *The Seattle Times*. The suit also says Microsoft's tactics are against the Federal

Trade Commission's rules on deceptive and unfair practices.

The second suit was filed in June in Haifa, Israel, alleging that Microsoft installed Windows 10 on users' computers without consent. Microsoft already paid out a \$10,000 award in a previous U.S. suit over similar circumstances.

Microsoft told the *Seattle Times* it believes the suits won't succeed. The *Times* also reports that Microsoft said Windows 10 upgrades (the *Times* report called them "updates") are a "choice, not a requirement."

The story behind the story: That's quite a disingenuous statement considering that Microsoft violated the known behavior of the Windows interface to essentially trick people into upgrading.

The "forced upgrade" saga

For a time, clicking the X in the upper right corner of the Windows 10 upgrade prompt window was interpreted as consent to upgrade to the new operating system. The typical expectation for all users is that clicking the X ends the program, and in fact, doing so was the *only* way to reject the free upgrade offer for most of the pop-ups notification's existence. The same prompt could upgrade your system to Windows 10 without explicit consent if you left your computer on for an extended period, as well. *PCWorld* received hundreds of reader complaints about "forced" Windows 10 upgrades after Microsoft began using those tactics.

Although Microsoft used aggressive upgrade tactics for several months, more recent upgrade offers have been significantly dialed back. In late June Microsoft revamped the upgrade pop-up that offers Windows 7 and 8.1 users a free bump to Windows 10. The expected behavior of the X returned, and Microsoft offered clearer options to stop receiving the free upgrade offer altogether.

Microsoft's free upgrade period for Windows 10 closed July 29. 

You can't turn off Cortana in the Windows 10 Anniversary Update

BY IAN PAUL



MICROSOFT MADE AN interesting decision with Windows 10's Anniversary Update, which is now available.

Cortana, the personal digital assistant that replaced Windows 10's search function and taps into Bing's servers to answer your queries with contextual awareness, no longer has an off switch in Windows 10 Home and Pro.

The impact on you at home: Similar to how Microsoft blocked Google compatibility with Cortana (go.pcworld.com/cortanaedge), the company is now cutting off the plain vanilla search option. That actually makes a certain amount of sense. Unless you turned off all the various cloud-connected bits (go.pcworld.com/w10privacy) of Windows 10, there's not a ton of difference between Cortana and the operating system's basic search capabilities.

Microsoft even says as much: "With the Windows 10 Anniversary Update, the search box is now Cortana," Microsoft said in a statement.

“Customers can expect the same great search experience powered by Bing and Microsoft Edge with the added benefit of Cortana’s personality.”

In fact, the biggest functional difference is that Cortana is far more useful (go.pcworld.com/w10cortanaguide) than plain search thanks to the digital assistant’s handy voice commands, reminders, the ability to send text messages, and so on. That said, Microsoft’s move is probably less about the practical differences between Cortana and search, and more about pushing people to use Cortana.

But what if you still don’t want to use Cortana at all?

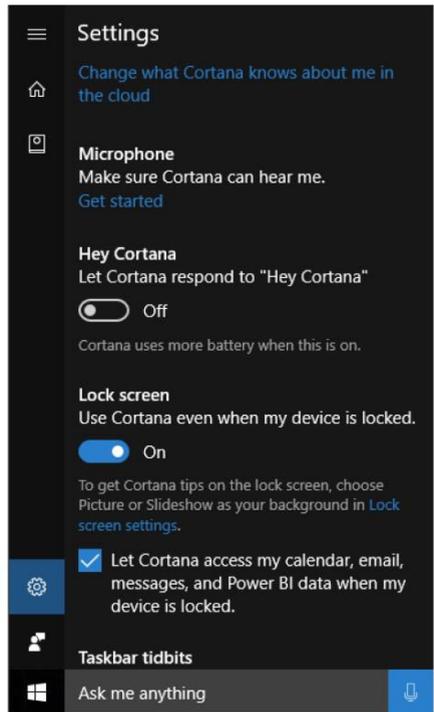
Refusing to download the Anniversary Update is not an option. You can delay it, but since Windows 10 updates are mandatory (go.pcworld.com/w10updhomeuser) for home users, you’ll eventually receive the update.

“Cortana works best when you sign in, but if you choose not to, you can still use her to chat, search the web and your Windows device,” Microsoft told *PCWorld*. “If you like, you can also easily hide Cortana and the search box in the taskbar altogether.”

(Mary Jo Foley of ZDNet notes, ironically, that Cortana is *off* by default and cannot be turned *on* in specific editions of Windows 10 for education (go.pcworld.com/w10proedu), even with the Anniversary Update applied. But unless you work for an educational institution, you won’t be able to use them.)

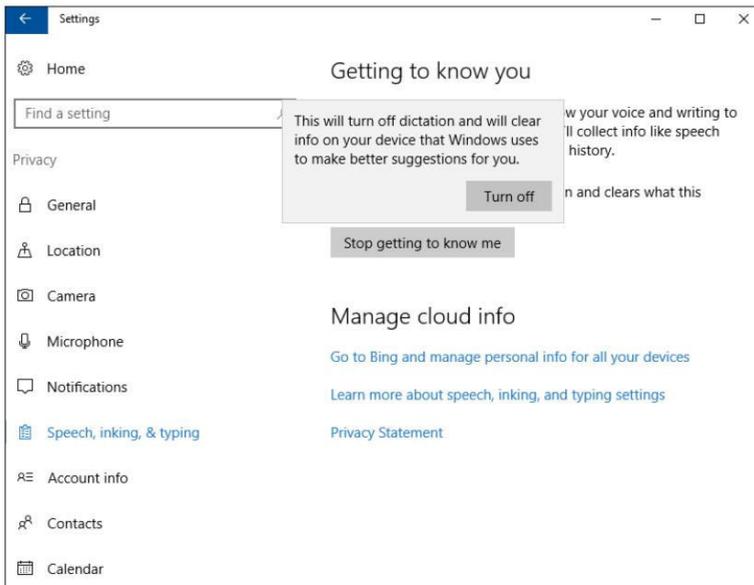
Set limits on Cortana

You can also take a few steps to limit Cortana’s reach on your system. First, head to *Start > Settings > Privacy > Speech, Inking & Typing*. Now click on Stop Getting To Know Me and then select Turn Off. This



Cortana’s settings in the Anniversary Update.

The privacy section of the Settings app in the Anniversary Update



effectively makes Cortana deaf to the sound of your voice as well as blind to your typing history and—for stylus wielders—handwriting patterns. It also turns off systemwide dictation.

If you're going to keep the search box on your taskbar, open Cortana and then click on the settings cog in the lower-right corner. On Cortana's settings screen, disable every slider that can be set to Off, such as search history and device history. That helps prevent some data usage and tracking, but Cortana will still be working.

To wipe Cortana's memory of you, click on Change What Cortana Knows About Me In The Cloud, which is at the very top of the settings panel. On the next screen, scroll down to the bottom and click Clear. This orders Microsoft to delete any information it has saved about you via Cortana, including personal interests, browsing history, and so on. If you're going to use Cortana but feel uneasy about its data collection you should clear this option periodically.

You can even get rid of Cortana's presence entirely, as Microsoft said.

You can even get rid of Cortana's presence entirely, as Microsoft said.

Name	Path	Size	Date Modified
amd pc gaming	C:\Users\Sticky\SkyDrive\PC World		7/2/2012 5:44 PM
Gaming	C:\Program Files (x86)\ASUS\AJ Suite II\BarGadget\resource\logo		12/9/2012 10:38 AM
Gaming	C:\Program Files (x86)\ASUS\AJ Suite II\BarGadget\resource\main_button		12/9/2012 10:38 AM
Gaming	C:\Program Files (x86)\ASUS\AJ Suite II\BarGadget\resource\Prome		12/9/2012 10:38 AM
Gaming	C:\Program Files (x86)\ASUS\AJ Suite II\resource\background		12/9/2012 10:38 AM
Gaming Desktops	C:\Users\Sticky\SkyDrive\Documents\ConsumerSearch\Reports		12/9/2012 11:32 AM
Gaming_slider	C:\Program Files (x86)\ASUS\AJ Suite II\TurboV EVO\resource\slider		12/9/2012 10:40 AM
googlegaming	C:\Users\Sticky\Downloads		5/3/2013 12:24 PM
msioutsfirstgaminglaptopswithamdri...	C:\Users\Sticky\Downloads		5/22/2013 10:27 AM
1 who says pc gaming is dead.JPG	C:\Users\Sticky\SkyDrive\PC World\e3\pc hardware	1,282 KB	6/12/2013 3:04 PM
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Brendan Irbe non-gaming Oculus VR 6...	C:\Users\Sticky\Desktop\Desktop files for sorting	29,858 KB	2/4/2013 2:22 PM
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To do this, right-click on the Cortana search box, and select Hidden. (Note that if you leave Hey Cortana turned on, the Cortana box will reappear when you say those words, or you can use the Cortana app.)

After that's done you can also go to Bing Maps to edit your saved places (if you have any) as well as Bing's search history page to clear information stored about your search habits.

Use an alternative

If you're still unsatisfied after you've crippled as much of Cortana as possible, consider ditching it completely and going with a third-party system search utility instead. If you aren't using Cortana's web-connected features, all you really need is file and folder search, anyway.

One of our favorite third-party search tools is Everything (voidtools.com). This wonderful donationware is small, simple, easy to use, and (most importantly) fast. You can also pin Everything to your taskbar to make searching as easy as Microsoft's built-in solution.

Of course, another alternative is to dump Windows 10 altogether and switch to Linux. That's certainly a valid alternative. *PCWorld's* guide to the best Linux distros for beginners (go.pcworld.com/linuxdistros) and Windows XP refugees (go.pcworld.com/linuxalt) can help get you up to speed if you decide to opt for that drastic solution. 



AT&T Mobile Share Advantage mimics T-Mobile, dropping overages in favor of throttling

BY GLENN FLEISHMAN

WITH AT&T'S MOBILE Share Advantage, the telecom giant follows a new trend: Customers who switch to this new shared mobile plan (available August 21) will be spared bandwidth overage fees. Instead, the firm said, after available bandwidth is used up, its Mobile Share Advantage customers will be throttled to 128Kbps for the rest of the current billing cycle.

The Mobile Share plans pool bandwidth among devices that can include smartphones, feature phones, tablets, gaming devices, wearables, laptops, hotspots, and other hardware. A monthly charge per device is paired with a charge for a tier of bandwidth.

AT&T joins T-Mobile and Sprint among the big four U.S. carriers in shifting to throttling instead of causing customers to rack up fees at \$10 per gigabyte above plan totals.

Why this matters: AT&T joins T-Mobile and Sprint among the big four U.S. carriers in shifting to throttling instead of causing customers to rack up fees at \$10 per gigabyte above plan totals. That's good news for consumers, though it'll be interesting to see whether they'll tolerate throttling or break down and buy more bandwidth, sending more money to the carriers after all.

Digging into the details

The Mobile Share Advantage plans include all the same basic features as the previous Mobile Share Value plans: unlimited voice calling and texting within the United States, one-month rollover of unused data, and pooled data among lines on the same account. But it gets better: Higher-tier Value plans added fee-free voice, text, and pooled data use in Mexico, unlimited texting from the U.S. and Mexico worldwide, and unlimited calling from the U.S. to Canada and Mexico. Those offerings are part of more lower-tier Advantage plans (10GB and above); unlimited texting from the U.S. to more than 120 countries comes with all plans now.

The new plans also include larger usage pools at the same price tiers as AT&T's current Mobile Share Value service. AT&T has eliminated the 300MB tier, formerly \$20 a month, and reduced its \$30 tier from 2GB to 1GB. All higher-bandwidth tiers are cheaper per gigabyte. Plans can be swapped mid-month if additional usage (or less) is required.

The company used to charge \$25 per contract-free smartphone or feature phone per month for lower tiers of shared bandwidth and \$15

per month for higher tiers. It's simplified this to \$20 per month for all phones. Business plans, which start at 25GB, pay \$15 per smartphone per month. AT&T said the monthly device fee still ranges from \$10 to \$40 per month for other kinds of devices, including phones under contract.

AT&T said that consumer plans start at 1GB and span to 100GB and allow up to 10 lines. Business plans start at 25GB and go as high as 200GB, and can comprise as many as 25 lines.

Consumers stand to save under the new plans. A two-smartphone household that previously had a 300MB plan and paid \$70 a month could move to the 1GB tier under the new pricing structure and pay the same, because of the lower per-line fee. A higher-tier family at the 15GB level and four phones would be paying \$160 a month today, and would pay \$170 for 16GB or \$160 for 10GB in the new pricing structure. AT&T has retained its previous rollover option of just one month, while T-Mobile's spans the previous 12 months. 🛑



Verizon will cut off unlimited data users who use too much unlimited data

BY IAN PAUL

VERIZON'S CONTINUING ITS ongoing mission to pare down the number of customers on unlimited data plans by migrating them to ones with hard limits. Recently, the company came up with a way to get rid of its biggest data hogs.

Verizon is notifying customers using an “extraordinary” amount of data per month that they must move off their unlimited data plan by

August 31. If they don't switch, the carrier will disconnect their accounts, though they'll have 50 days to reactivate them on a limited plan, as first reported by Droid Life.

Verizon ceased offering unlimited data plans in 2011.

The impact on you:

"Extraordinary" usage appears to be people who are sucking down more than 100GB every month.

Verizon told Ars Technica

that a very small number of users are exceeding 100GB every month on a single device. The carrier deems this as extraordinary since its largest monthly plan offers that amount of data as a shared bucket used by multiple devices.

"Extraordinary" usage appears to be people who are sucking down more than 100GB every month.

Every step counts

Verizon's latest ploy to move people off unlimited data plans will likely affect a very small number of the carrier's customers. Nevertheless, Verizon feels it needs a way to prevent heavy data users from gobbling up network resources—or at least get them to pay a higher price for it.

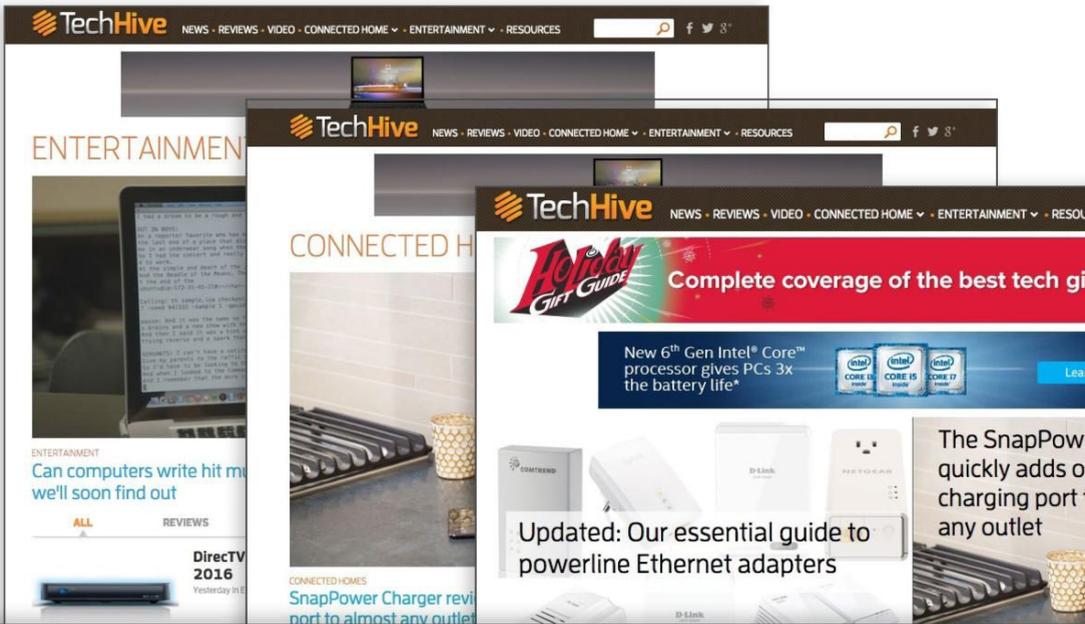
Other anti-unlimited measures by Verizon haven't been so small scale. In 2012, Verizon said it would force anyone on an unlimited plan to switch away from that plan when they upgraded to 4G LTE phones. That apparently never happened, since by 2014 Verizon was threatening to throttle unlimited data plan customers who were using too much data on its LTE network.

Verizon backed off its throttling plans for LTE after a tussle with the Federal Communications Commission. The company then ceased throttling 3G users in August 2015 after the FCC enacted its net neutrality policy for carriers and home broadband ISPs. Verizon's most recent move against unlimited data plan holdouts happened in October 2015, when the company upped the price of its unlimited data plans from \$30 to \$50. 🛑



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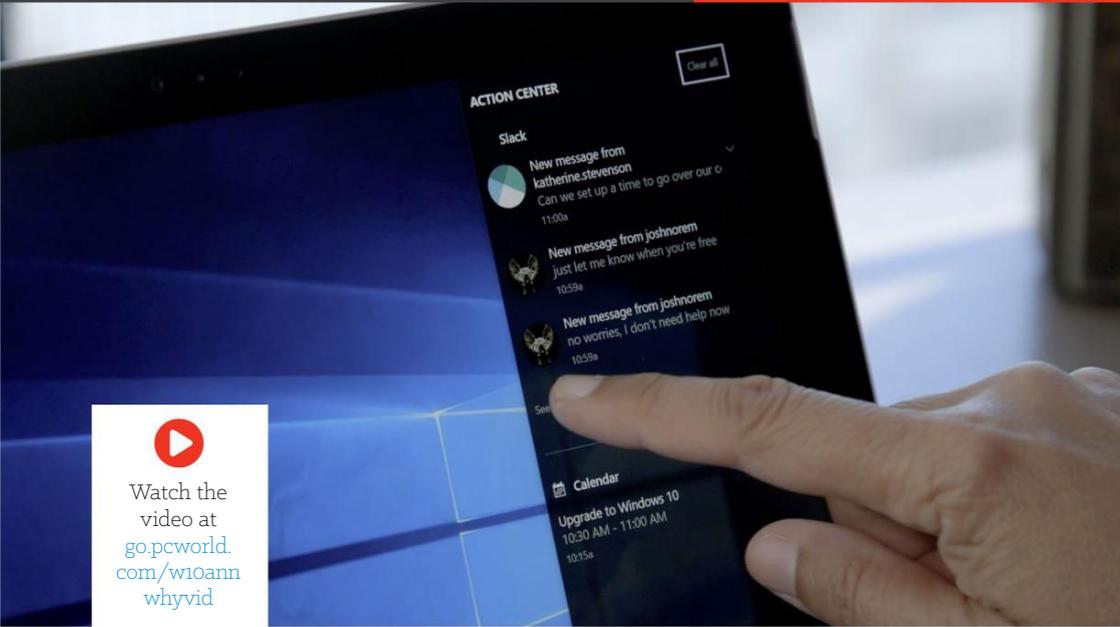
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In this section, hardware & software go through rigorous testing.

REVIEWS & RATINGS



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Windows 10 Anniversary Update review: Cortana, Edge overshadow Windows Ink

BY MARK HACHMAN

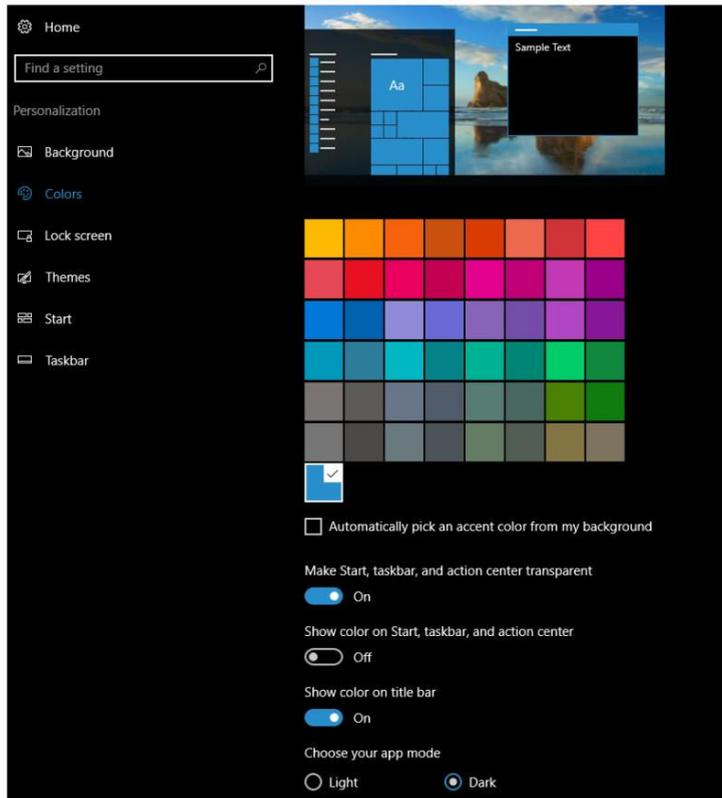
I JUST SPENT MORE than a week diving deep into Windows 10's Anniversary Update. As a birthday present of sorts to users who've upgraded to Windows 10 in the past year since the OS launched, it's a pretty nice one.

Here's what's in the box: Cortana, which is now accessible from the lock screen, is more ubiquitous than ever. Extensions finally make Microsoft Edge usable. Windows Hello improves, Skype's reboot seems to be on the right track, and underneath it all are even more thoughtful tweaks that improve Windows 10's overall experience. The new Windows Ink is intriguing, if only partially baked. One or two features you may have expected aren't quite ready.

But if you're a Windows user still on the fence, the Anniversary Update won't sway you. This isn't Windows 8.1, Microsoft's apology for the sins of Windows 8. Some of the skeptics' biggest reservations about Windows 10, such as the demand for a Microsoft account, or the many and varied attempts to keep tabs on your activities, clearly are here to stay.

Think of the AU instead as a milestone in Windows 10's journey, a chance to polish some features and bring on a few others. We used all

One of the most anticipated features of the Anniversary Update has been dark mode.



this as a foundation for our review score for the Anniversary Update, which we left unchanged from what we gave the original release (go.pcworld.com/win10rev).

Windows Hello— a key selling point

Microsoft's Anniversary Update was supposed to take the Windows Hello biometric authentication system a step further, finally delivering on the "Passport" promise of the original OS: Your face or fingerprint would serve as your password for the web as well as your PC. Microsoft executives tell me Hello will take on this new role once the FIDO 2.0 standard officially rolls out in a few months. For now, Hello is now used to authenticate you at the Windows Store.

Microsoft's original Surface tablets used a depth camera to snap a 3D image of a user's face, identifying and logging them in. Now, Hello has become even more accessible, as more hardware makers adopt fingerprint readers. Both bits of hardware work exceptionally well—and if they don't, there's always a PIN or Microsoft password alternatives.

Now, Microsoft is pushing Hello beyond your login screen, and the first stop is the Windows Store. The AU code now uses Hello to buy apps, music, and more. What's the difference between tapping a button to approve a stored credit card, versus using your face? Not that much, though the transaction is authenticated via the hardware in your PC, providing an

Microsoft Windows 10 Anniversary Update

AT A GLANCE

Microsoft's Windows 10 Anniversary Update delivers moderate but meaningful improvements to those features you use most, while pointing the way to more substantial improvements down the road.

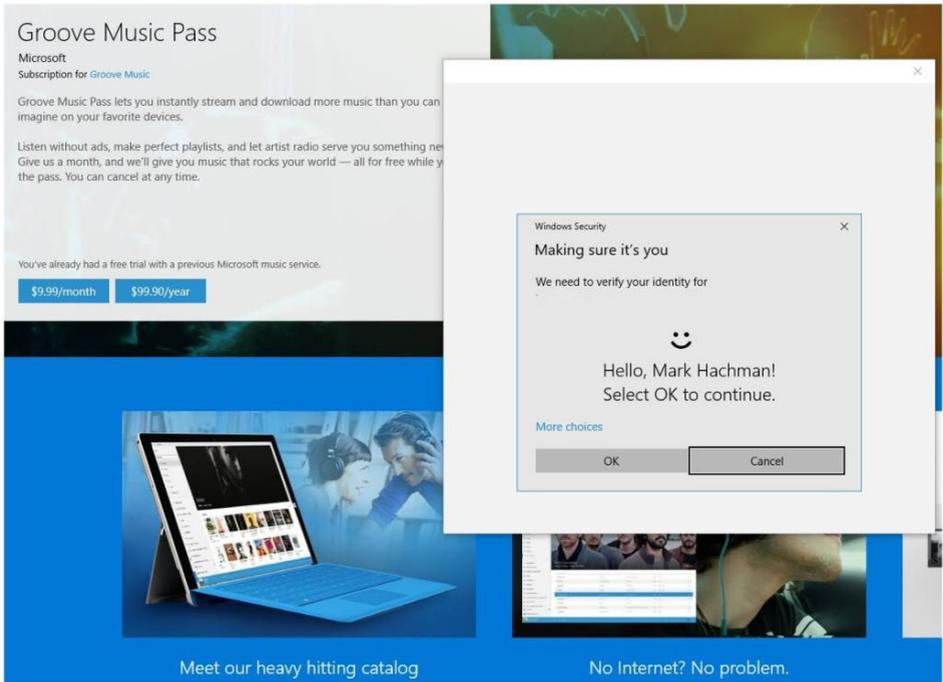
PROS

- Microsoft Edge has significantly improved, in performance and features
- Cortana is now accessible from the lock screen
- Minor upgrades throughout Windows 10's apps
- It's free!

CONS

- Windows Ink is promising, but far from finished
- Just properly integrate OneDrive, already
- The bugs are still there, in places





additional assurance that you are you.

I still think replacing passwords via biometrics is the future of shopping on the web, but restricting it to Store purchases helps ease users into this new technology. A lot is going to depend on which sites adopt Hello authentication, especially banking sites.

Cortana: Eager to please, and with a better memory

If you believe that Microsoft is the devil in Redmond, gobbling up your data to pass along to advertisers (or worse), nothing about Cortana's latest features will change that. (But you'll be happy to know that the French government agrees with you go.pcworld.com/win10datacollection.) That said, the Cortana digital assistant has steadily improved since the initial release of Windows 10. The Anniversary

You'll soon have the option to secure purchases at the Windows Store with your face or fingerprint.

Update presents a Cortana that's more aware of you than ever, assuming you allow her access to your life.

In the Anniversary Update, you can't turn Cortana off, though you can periodically wipe out her memory by erasing what she knows (bing.com/account/personalization) and by disabling Windows's 10 personalization features via the Privacy options in Settings.

Cortana can now speak several languages, sniff your email for flight times and other pertinent data, and more. Two key additions make Cortana especially useful, however: Her hangout on your lock screen, and her ability to remind you of basically anything.

This is a great trick: You can holler across the room—"Hey Cortana!"—and trigger a few actions on the lock screen, without needing to log in. Cortana can tell you your upcoming appointments, or even tell you a joke. One of the product managers responsible for Cortana told me that she likes to see her calendar on her screen across the room, and she's right—that sure is handy.

The other useful addition to Cortana's repertoire is that you can now set a "reminder" for a random fact: "Remember that my room number is 1443," or "Remember that my nephew likes Ghostbusters toys." Later, when you need to, you can then ask "What is my room number?" or "Tell me the toys my nephew likes."

The best summary of Cortana's capabilities lies within the Cortana

More tablet makers are including fingerprint scanners, a more compact way of enabling Windows Hello. Here, a scanner nestles between the volume rockers of the Huawei Matebook.



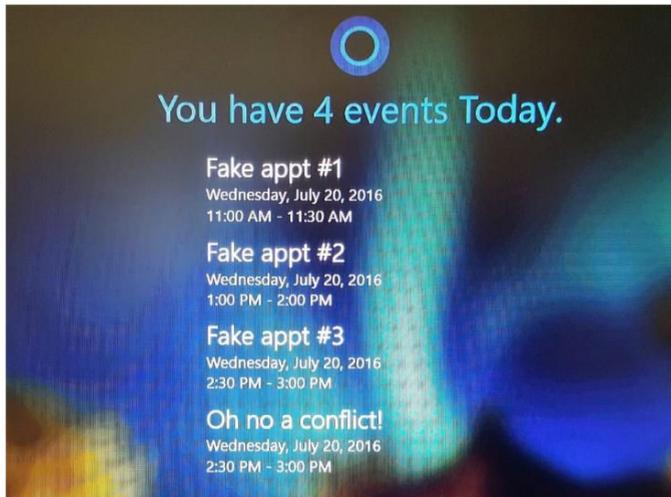
Notebook, where you'll find all sorts of little tidbits: Do you want Cortana to know when you typically eat lunch, and schedule around it? To connect to your fitness tracker? To make restaurant suggestions? I fire off reminders to myself all the time, just by yelling at Cortana while tapping away at something. And you can send texts to Android and iOS phones, too, if you've installed the Cortana app.

Edge: extensions make the difference

Edge, Microsoft's integrated browser, was a glaring flaw in the original Windows 10 release: too spare, too slow. Even now, as Windows 10 boasts a decent 19.1 percent (netmarketshare.com) market share, Edge's share sits at just 5.1 percent. It still deserves mention here, though, because it's steadily and surprisingly improved over time (although no specific improvements are really recent enough to be part of



You can't turn technically turn off Cortana in the Anniversary Update, but you can make her deaf, dumb and blind if that's what you want.



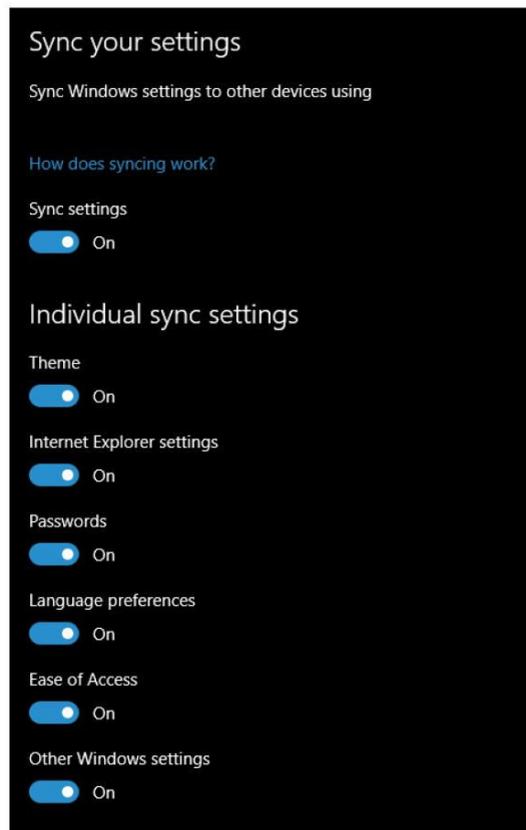
With the Anniversary Update for Windows 10, you can get a simplified view of your calendar on your PC's lock screen.

the Anniversary Update). Edge now syncs data with the cloud, adds extensions, and even offers integration with Cortana.

When Windows 10 debuted, neither Edge's Favorites nor its stored passwords easily synced with the cloud, which is especially frustrating when moving to a new PC. There were workarounds—I could store favorites in Chrome, install the browser, load the favorites, then export them to Edge—but that was a pain. Now, as long as you sync everything to your Microsoft account, all of that data should roam between devices. Just make sure to visit Settings > Accounts > Sync Your Settings and verify your identity.

The Anniversary Update code now contains support for extensions, a feature the original version of Edge notably lacked. At press time, 13 Edge extensions are available via the Microsoft Store, none of them fluff: AdBlock and AdBlock Plus, the LastPass free password manager, an Evernote Web clipper, and more. They're easy as pie to install: Simply go to the ellipsis menu at the upper right, scroll down to Extensions, and install them like any other app. (For more detail, check out *PCWorld's*

Top: Cortana does ask for information from a variety of connected accounts, though they're off by default. In part, that's to help you plan out getting to and from meetings, say, via Uber. **Bottom:** As long as you confirm your identity, Edge Favorites and passwords should now be exchanged among Windows 10 devices you have keyed to your account.



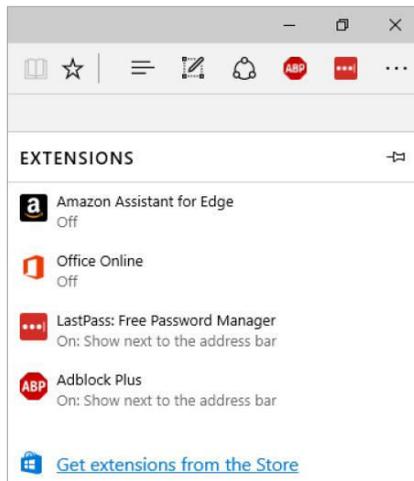
More than a dozen extensions add some long-awaited, and much-needed, extensibility to Microsoft's Edge browser.

The new Edge extensions sit in the upper right, and can be accessed via the ellipsis menu. Note that you can turn them on or off as you wish.

	<p>Evernote Web Clipper by Evernote</p> <p>NOTE: This extension only works on preview build 14372 and later. Use the Evernote extension to save things you see on the web into your Evernote account. Goodbye, bookmarks. Hello, Web Clipper! Clip the web pages you want to keep. Save them in Evernote. Easily find them on any device.</p> <p>Open in Store</p>		<p>Office Online by office.com</p> <p>NOTE: This extension only works on preview build 14366 and later. The extension lets you edit, and create Office files in Word, Excel, PowerPoint, and OneDrive for Business. Work on the go - Get anywhere, thanks to integration with OneDrive for Business.</p> <p>Open in Store</p>
	<p>LastPass by lastpass.com</p> <p>NOTE: This extension only works on preview build 14357 and later. LastPass, an award-winning password manager, saves your passwords and gives you secure access from every computer and mobile device.</p> <p>Open in Store</p>		<p>Adblock by getadblock.com</p> <p>NOTE: This extension only works on preview build 14342 and later. The extension has over 200 million downloads. It blocks ads on the web.</p> <p>Open in Store</p>

guide to effectively using Microsoft Edge (go.pcworld.com/edgehowto).

Whether you like the new Edge depends on whether you have an ad blocker installed. Without it, web browsing still remains choppy. With it turned on, though, Edge now is in the same league as other browsers, rendering webpages about a second slower than the competition. I still found Edge somewhat unstable, though, crashing on media-rich pages at sites such as CNN.com and SFGate.com even with ad blocking on. Fortunately, such crashes rebooted the tab, with no apparent ill effects to the other tabs. I just hope that the crashes can be chalked up to a

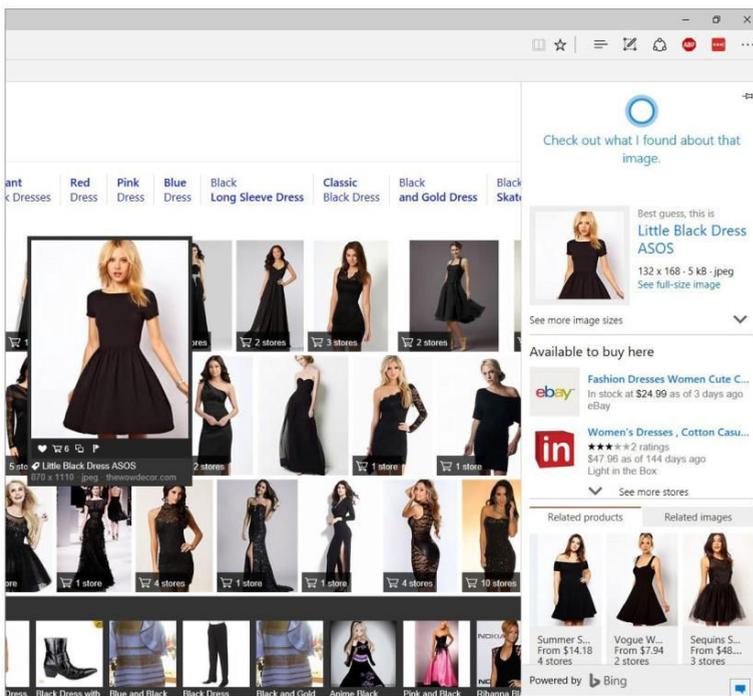


bad ad, rather than an issue with the Edge code.

We all shop online, and Edge has added a few handy features. Edge is integrated with Cortana (go.pcworld.com/cortanaedge), so the digital assistant will return results, using Bing and Edge, that she can't find herself. Better still, when you visit a shopping site like BestBuy.com, she'll offer you a coupon. (Check out the MacBook Air discount!)

Right-click an image (of a dress, lawn mower, or whatever) and Cortana will pull up a sidebar with price and availability at various online locations. I'm not ready to call Edge a great browser, but it's risen to the level of acceptable.

Next up: How seriously should we take Windows Ink? 



Microsoft Edge allows you to right-click an image and “ask Cortana” to find places where you might be able to buy the object in question.

Continued: **Windows 10 Anniversary Update**

Windows Ink: Just the basics of pen computing

BY MARK HACHMAN

PEN COMPUTING HAS been part of the Apple Newton, the Tablet PC, the Surface Pro 3, and other devices. But the PC world has never really answered the central question concerning the pen: What exactly do you do with it?

Virtually everything about Windows Ink was designed for the Anniversary Update. OneNote used to be Microsoft's great inking application; now, a collection of native Windows Ink-powered apps (which originated from the massive Surface Hub)—Sticky Notes, Sketchpad, and Screen Sketch—is elbowing into its territory. And if those aren't good enough, a curated collection of inking apps are now



One of the new ways to interact with your PC is via the pen.

Top: Windows Ink begins with this tiny icon on the Windows 10 taskbar.

Bottom: Click the pen icon, and Windows will launch the Windows Ink Workspace, a collection of ink-specific apps.

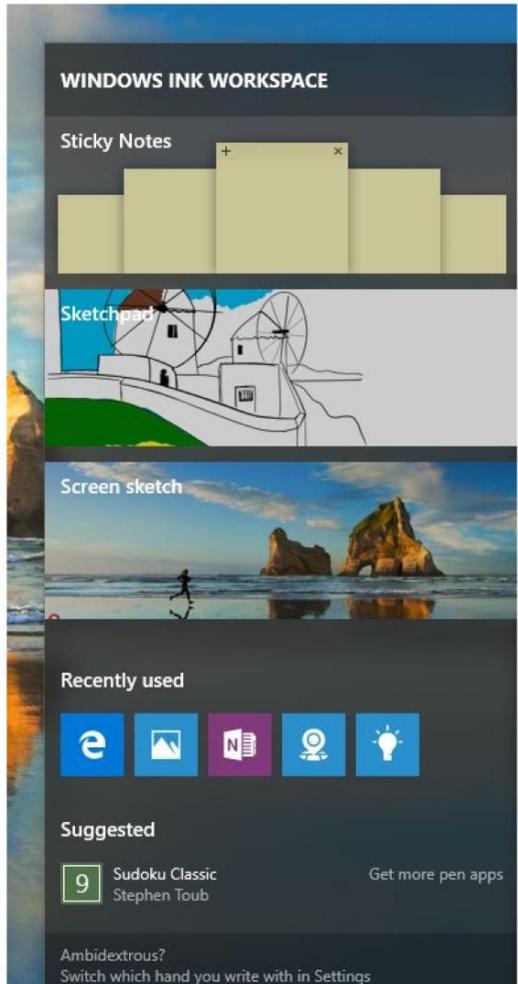


in the Windows Store.

A few years ago, Microsoft executives showed a Surface Pro 3 tablet that could be written upon just by clicking the stylus, even without unlocking the PC. Today, that same feature (which, due to a bug or faulty Surface Pen, I could not get to work) unlocks the Windows Ink Workspace and any of the associated apps. They're also found behind the new pen icon, in the Windows taskbar.

Of the three Workspace apps, neither Sticky Notes nor Sketchpad particularly impress me. Sticky Notes simply plop themselves on your screen—yes, like tiny, physical sticky notes. A late-breaking tweak just before the Anniversary Update launched added the Insights feature, which allows Bing to interpret a scrawled flight number, for instance, as actual, actionable data.

Sketchpad's existence, meanwhile, basically tells me that Microsoft felt OneNote, even the simplified Metro version that shipped with the



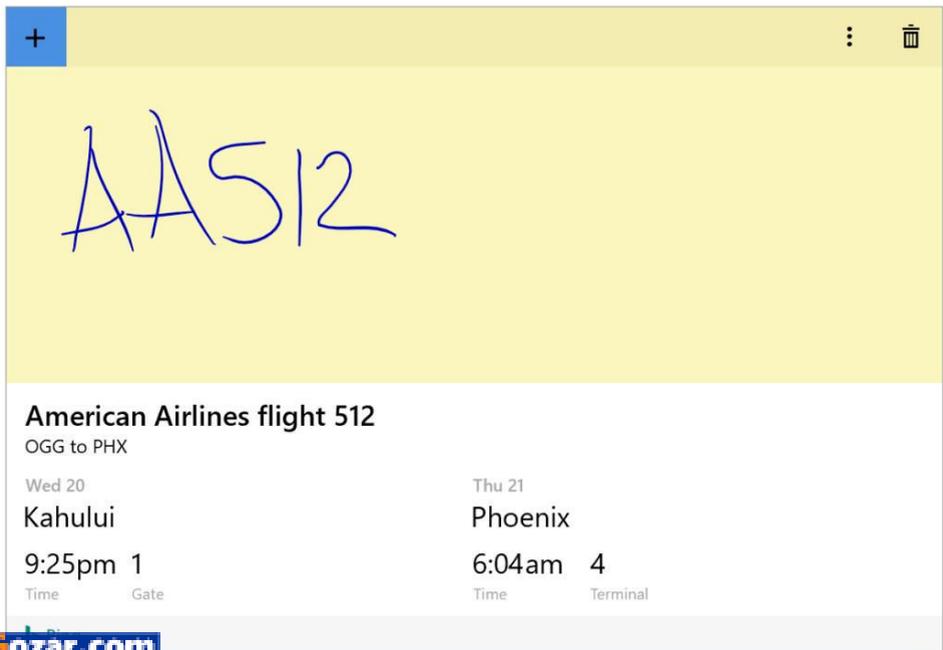
Surface Pro 3, was simply overkill for what users want to do: scrawl a quick note. Sketchpad, though, doesn't quite fix things: It feels more like a drawing tool than a note-taking app. What I'd like to see is for Sticky Notes to go away and Insights to migrate to Sketchpad. Ideally, Windows would "read" all of your digital scribbles, anyway—or at least those that you've designated.

Screen Sketch, meanwhile, reminds me of how I use a Galaxy Note smartphone: for grabbing webpages or scrawling a note, and posting them online. My beef is how Windows fails to recognize that my primary desktop monitor is not touch-enabled, and dumps both Screen Sketch and Sticky Notes there, rather than on my touchscreen directly next to it.

I never thought I'd say this, but there's a section of the Windows Store worth checking out, and that is the Windows Ink section. It contains at least 40 apps, all curated for pen use. This is a refreshing change: a smart collection of apps organized with a purpose.

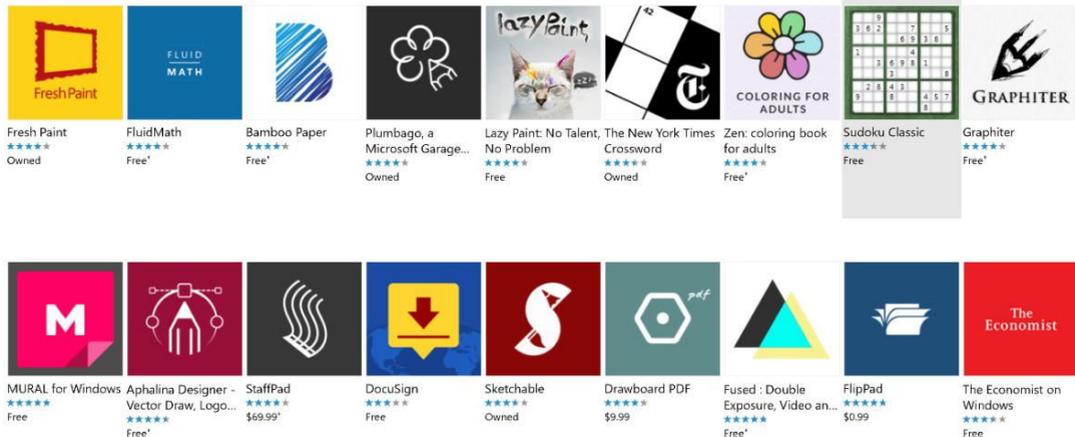
One expected feature, digitally inking a route in the Maps app, isn't

As long as you have Insights turned on as an option, Cortana and Bing can interpret certain notes as items that they can pull up more information on.



Windows Ink Collection

Make your mark. Use your pen to set your ideas in motion with the apps in this collection.



 Fresh Paint ★★★★★ Owned	 FluidMath ★★★★★ Free*	 Bamboo Paper ★★★★★ Free*	 Plumbago, a Microsoft Garage... ★★★★★ Owned	 Lazy Paint: No Talent, No Problem ★★★★★ Free	 The New York Times Crossword ★★★★★ Owned	 Zen: coloring book for adults ★★★★★ Free*	 Sudoku Classic ★★★★★ Free	 Graphiter ★★★★★ Free*
 MURAL for Windows ★★★★★ Free	 Aphalina Designer - Vector Draw, Logo... ★★★★★ Free*	 StaffPad ★★★★★ \$69.99*	 DocuSign ★★★★★ Free	 Sketchable ★★★★★ Owned	 Drawboard PDF ★★★★★ \$9.99	 Fused: Double Exposure, Video an... ★★★★★ Free*	 FlipPad ★★★★★ \$0.99	 The Economist on Windows ★★★★★ Free

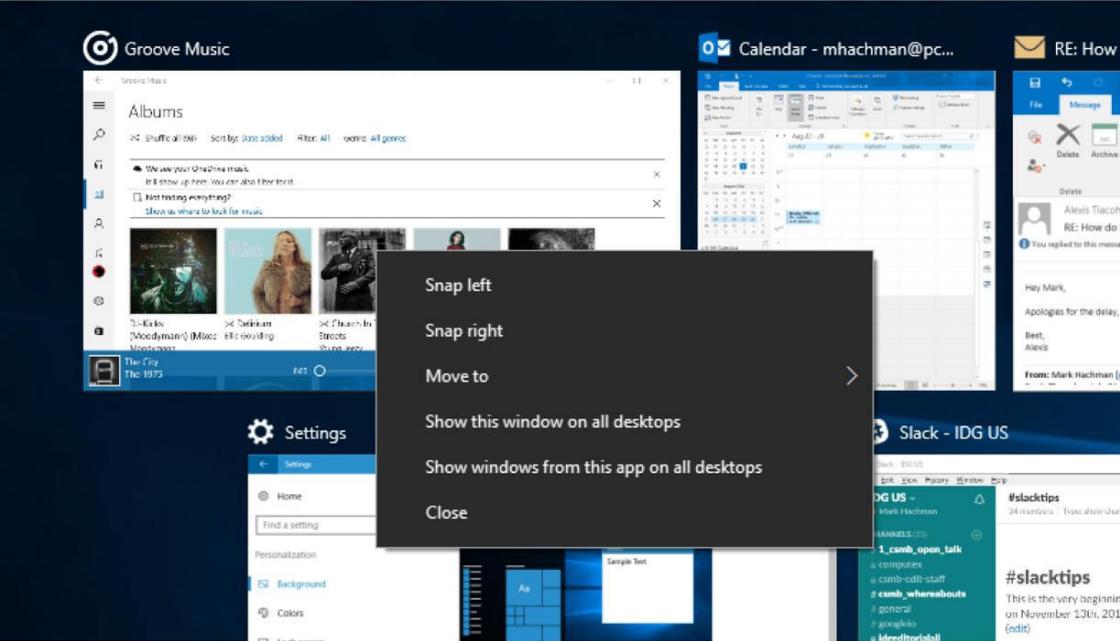
ready yet. Microsoft tells me it also plans to expand OneNote's smart inking—a freehand circle, for instance, converts to a machine-generated one—to equations. But this misses the point: Until Microsoft delivers the capability to interpret inked letters as rich, editable text, that can be inserted into Word or Outlook, Windows Ink isn't fully baked.

Task View and Snap: Still invaluable

The Anniversary Update doesn't change that much about Task View, Microsoft's virtual desktop utility, but it adds the ability to pin windows from a particular app to multiple desktops—not just one—and to do the same for multiple windows. It also allows you to pin a chat app or music player where it's always accessible.

I suspect that most users prefer to use multiple physical monitors, then forget about Microsoft's extremely useful Task View feature when they're confined to a notebook. Snap and Task View go hand in

Microsoft has helpfully collected many ink-enabled apps in the Microsoft Store. (There are more than what you see here.)



hand: You can snap apps to the four corners of a screen, or one to each side. Task View allows you to swap between these “screens” of apps with just a keystroke combination.

I just wish there were a simpler way to slide between desktops. Ctrl+Win+either Right or Left Arrow isn’t all that intuitive, and there’s still that pesky hard stop at the end of the row of virtual desktops. Perhaps Microsoft could implement a touchscreen gesture, or the three-finger swipe used to move between apps could be reassigned to desktops. That hasn’t stopped both Snap and Task View from remaining one of the most valuable features of Windows 10.

Under the hood: Hidden depths and Action Center

A number of minor features have been added to the Windows 10 code since last year, incremental improvements that sometimes fly under

A new Task

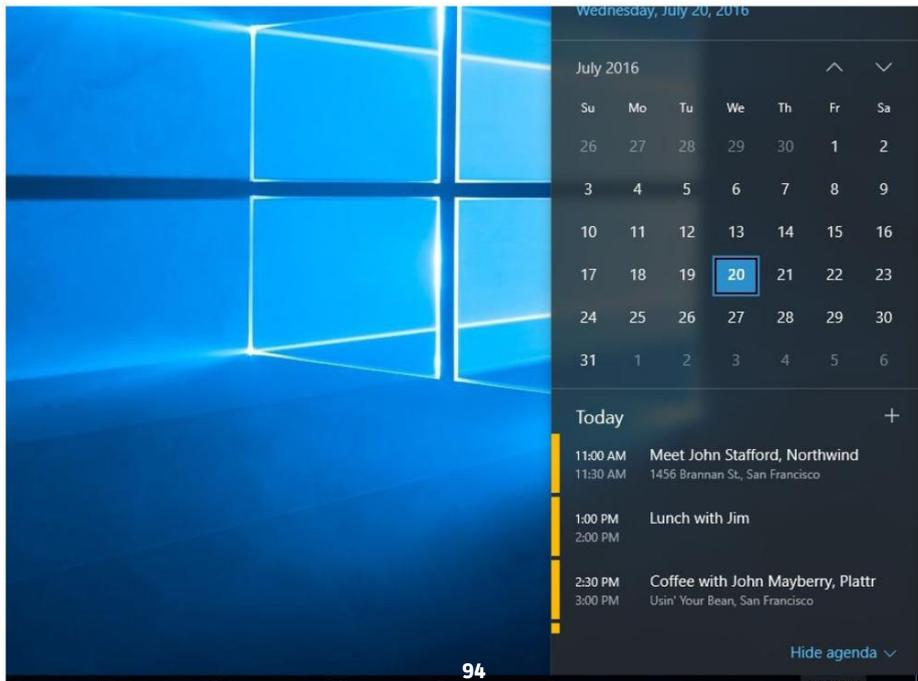
View option within the Windows 10 Anniversary Update allows you to pin an app to multiple desktops, such as Groove Music or Slack.

the radar. I highlight a few here that I think make a substantive difference: the addition of numbers to taskbar icons, dark mode, a quick calendar view, improvements to the Action Center, and a tweak for configuring audio sources.

Notifications are now an important component of the modern operating system, and the Action Center has improved in the last few months' worth of Insider Builds. Previously, the Action Center was dominated by whichever application had the most notifications (email, in my case). Now, it gives equal weight to various apps, tucking older notifications out of sight.

Windows will also show the number of total notifications in the Taskbar. Clicking the Taskbar's time/date will also show a concise view of your calendar for the day. That time and date will also show up on all of your displays—not just the primary one. Oh, and there's a dark mode, too, available in the Settings menu's Personalization section—but just for some UWP apps, and not Win32 apps or even the whole

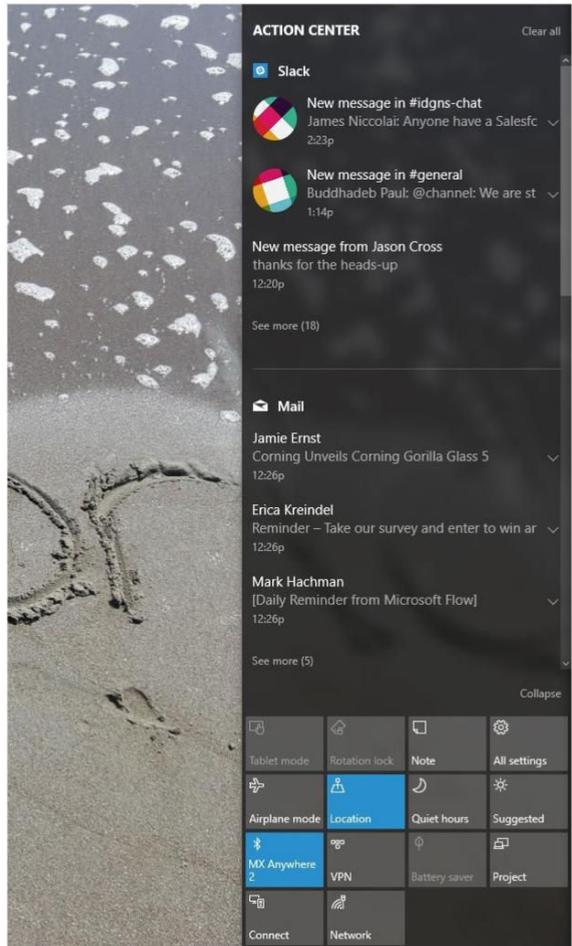
Click the time/date box on the taskbar, and a quick look at your day pops up. Also note the superimposed **1** badge over the Action Center icon: We're (almost) all caught up.



of the Windows 10 UI.

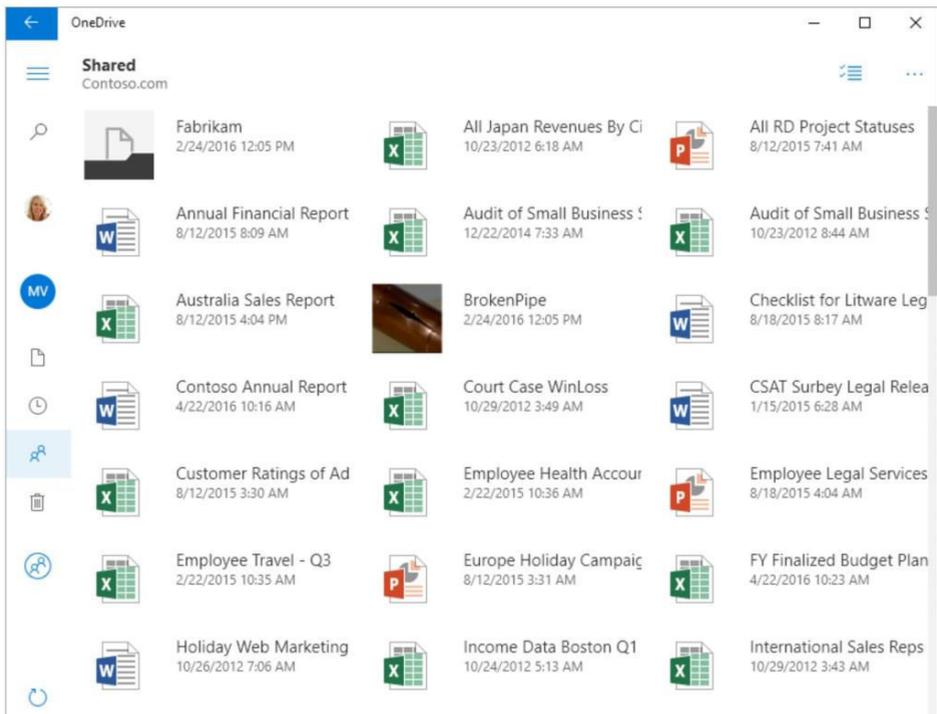
Here's one hidden feature I really love: Switching between audio sources (like headphones or tablet speakers) used to be a function of a buried control panel. Now, you can simply click the volume icon, then click the arrow above the slider to change your audio sources. (But there's still no graphic equalizer in Groove!)

Next up: OneDrive loses smart files, then gets them back, sort of. 🛑



Action Center now better organizes your notifications into categories. Note the quick settings icons at the bottom.

Continued: Windows 10 Anniversary Update



OneDrive: An app that meets you halfway

BY MARK HACHMAN

IN MAY, MICROSOFT launched a UWP OneDrive app (go.pcworld.com/uwponedrive), which helped address the loss of “smart” or “placeholder” files in the original release of Windows 10.

Windows 10’s Anniversary Update improves OneDrive in important ways. In my original review of Windows 10 last year, I wrote of OneDrive (go.pcworld.com/win10onedrive): “One feature has

The OneDrive app is a somewhat acceptable compromise between what Microsoft used to offer and what it should offer.

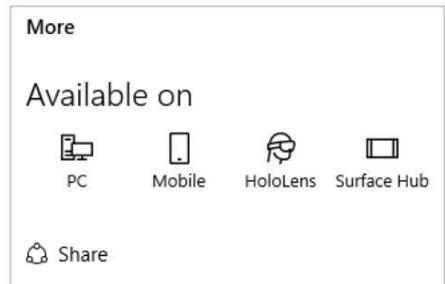
disappeared, though: the confusing ‘placeholder’ files that resided on your PC as a timesaving device. And that’s good.”

No, it’s not. That was simply wrong. OneDrive is a mess, and the placeholder files simply should be there today. Fortunately, OneDrive meets me halfway: It’s an app that functions like the OneDrive website, listing the files you’ve stored in the cloud. It’s also slow. But you can drag files into the app and OneDrive will upload them, so it’s almost, but not quite, as good as a dedicated folder.

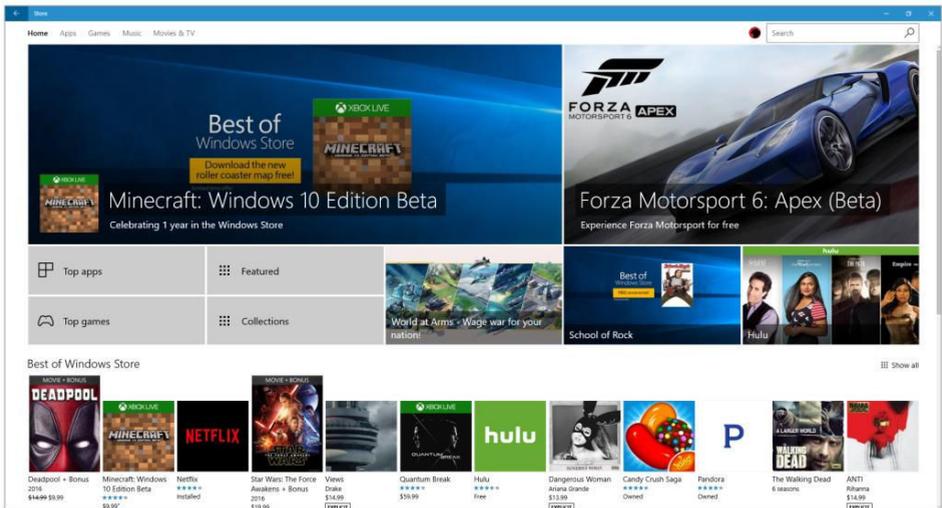
Windows Store: The triumph of UWP apps

Two things are noteworthy about the Windows Store: the new apps and descriptions that populate it, and the unnecessarily poor redesign that Microsoft forced onto it.

Microsoft’s Store app is already hamstrung by two issues: its relatively low



Above: Noting all the platforms a particular app runs on is one sign that Microsoft is unifying the Windows Store. **Below:** The front page of Microsoft’s Windows Store app.



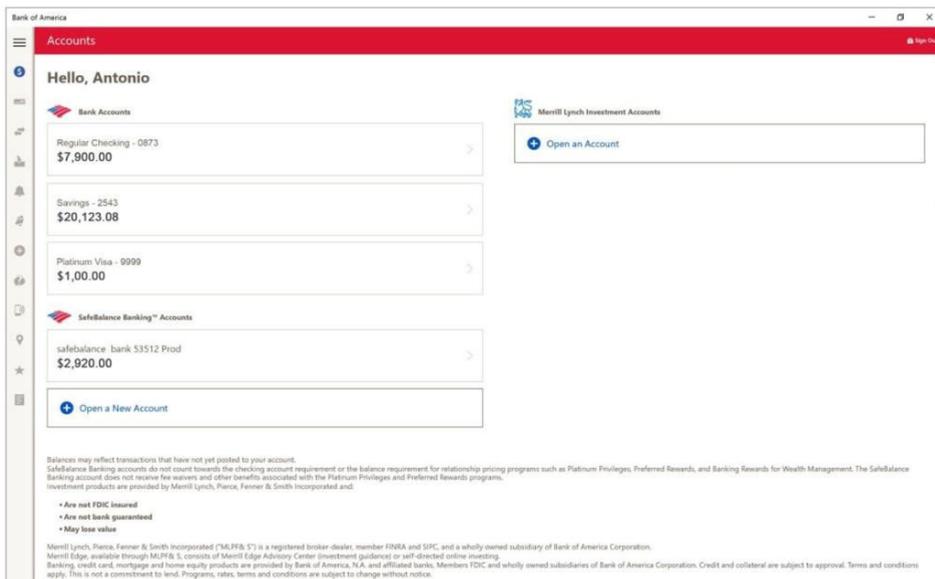
app count (669,000 Windows Store apps as of September 2015, versus 2 million or so for Android and iOS) and its need to push those apps at you. Unfortunately, Microsoft's Store redesign doesn't help.

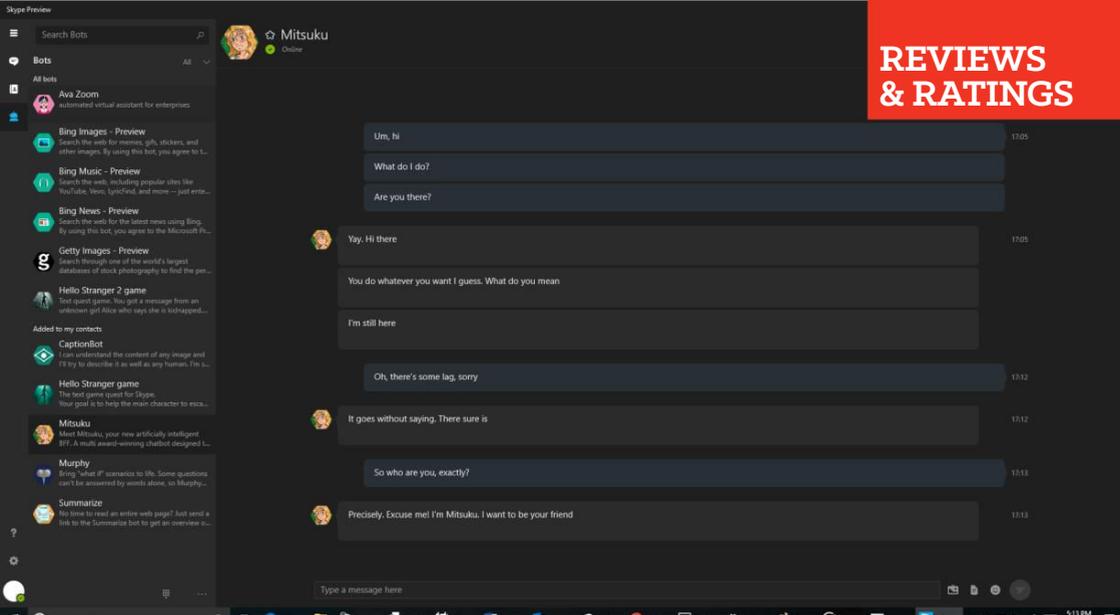
Customers obviously weren't scrolling down the page to find the Top Apps or Featured Apps, so Microsoft plopped four ugly boxes up top to capture your eyeballs. But what's the difference between Top Apps, Featured Apps, Collections, Best Of Windows Store, as well as Picks For You? Take it down a notch, Microsoft. We'll get there.

If you don't go beyond the first page of the Store, though, you'd never guess that Microsoft suffers from an "app gap" between itself and Android—almost everything on its front page is of high quality. Individual app pages have also been improved, clearly spelling out which platforms they run on, including mobile and PC. App ratings now can be viewed just for the latest version, which is handy. We still need some indication of how many downloads an app has, though, and when the most recent version was published.

Kudos to Microsoft for at least trying to elevate its Windows 10

Higher-profile brands like Bank of America add some much-needed credibility to Microsoft's app portfolio.





REVIEWS & RATINGS

reputation with a series of higher-profile game titles, though. These are the somewhat controversial UWP apps that straddle both Windows 10 and the Xbox One, including games like *Quantum Break*, *Rise of the Tomb Raider*, and even a nifty freebie, *Forza Motorsport 6: Apex*. Microsoft's purchase of Xamarin has apparently paid off with new, quality apps: Bank of America, Hulu, Fox Sports Go, Plex, and others. Let's hope it continues.

Skype Preview: To the point

Skype was notoriously left out of the original Windows 10 release, replaced with a Get Skype placeholder app. Now, Microsoft's prepared for the eventual re-release of Skype as a UWP app with Skype Preview, which so far has proven simple and effective.

Ignore all the silly love emoticons and other cruft Microsoft added to Skype earlier this year. Skype Preview does calls and messaging—even some of the new chatbots Microsoft highlighted at its Build conference—and that's about it. Premium features, such as translation, aren't quite there yet. Refreshingly, Skype Preview just logged me in using my Windows login credentials.

I'm not a huge Skype user, although I tend to have most of my overseas conversations using the service. Skype Preview might not be

The new Skype Preview supports a number of chatbots, but a bug prevented their responses from being displayed in real time.

the final, full-fledged UWP app, but it seems like it does everything I need it to do at the moment.

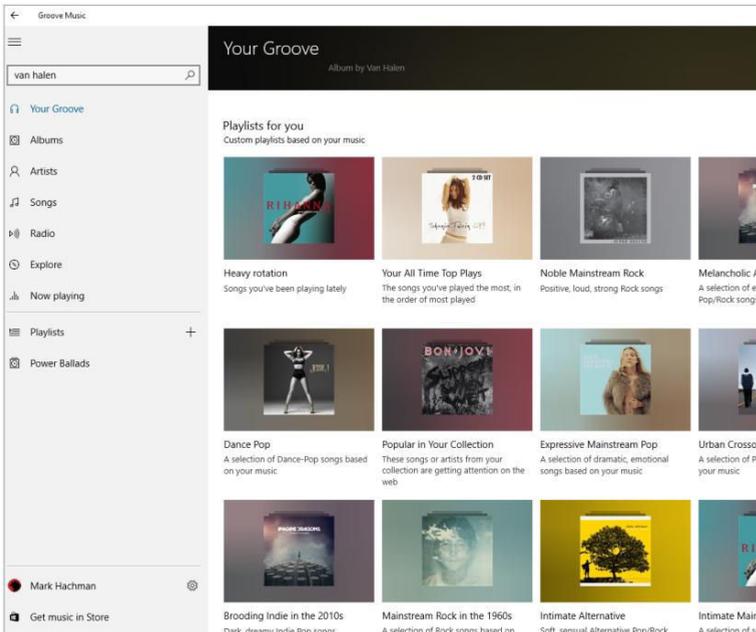
Other UWP apps get their own tweaks

You'll notice tweaks big and small to other UWP apps in the Anniversary Update. Here are the highlights:

One of the biggest is actually a new addition: the Bash app, which lets developers try out a Linux environment within Windows, without the need for a virtual machine. I'll confess that I know little about Linux, however, and can't offer any informed commentary on what the shell can or can't do.

Insider builds of the Windows 10 Mobile Photos app now capture video in slow motion, and a similar capability may be coming to the desktop Photos app as well. Unfortunately, Microsoft pulled it before the AU code shipped.

Mail's been updated with the ability to drag-and-drop calendar



With the version of the app that's available with the Anniversary Update, Groove Music now displays a (ludicrous!) number of customized playlists, based on what you listen to.

appointments. It's also—mercifully—much more stable, unlike in the early days of Windows 10.

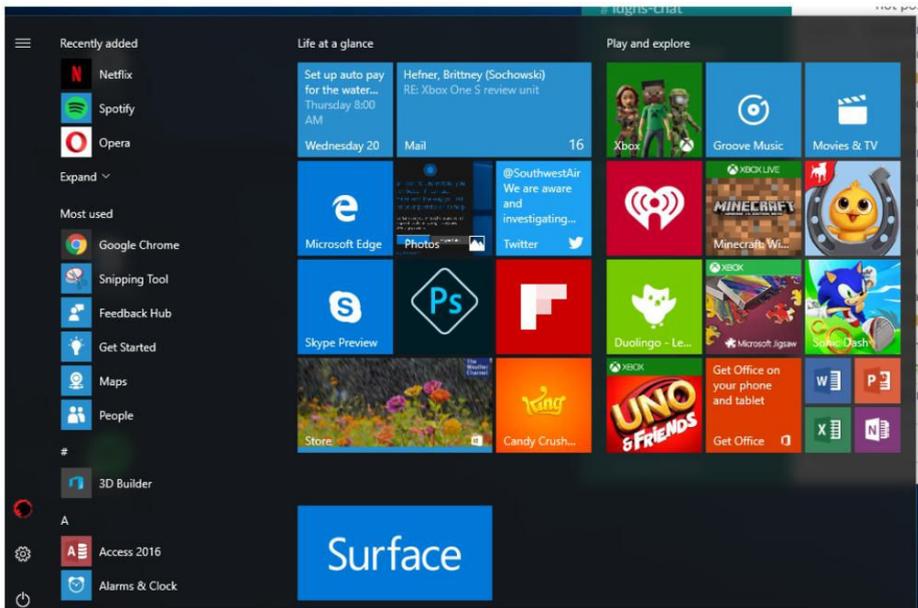
Finally, the Start menu looks just a shade different: What was previously an All Apps button is now just a scrolling list of apps, by default.

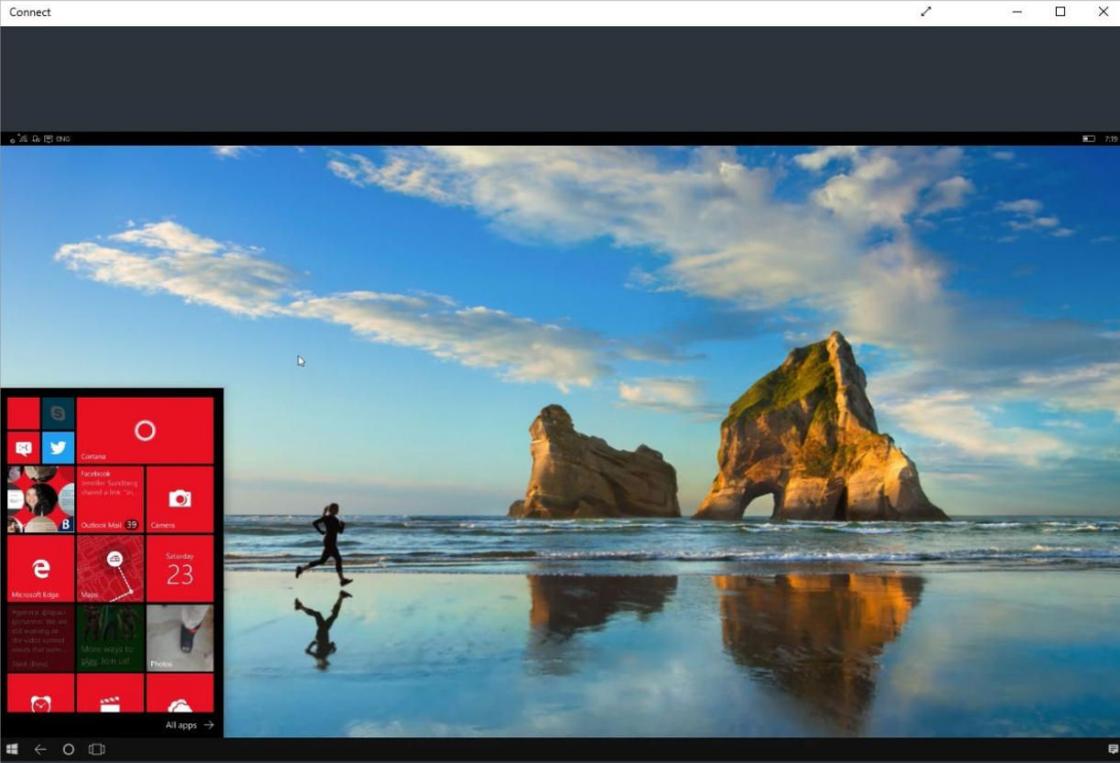
Connect: The Continuum you don't need

The Connect app marries your Windows 10 Mobile device to your Windows 10 desktop wirelessly, providing a Continuum-like experience without the cost of the Display Dock. I don't quite grok the Connect app on Windows 10.

Connect was one of the anticipated features of the Windows 10 Anniversary Update, partially because Connect projects your phone's display onto your Windows 10 PC screen, just like Continuum. But Connect simply connects your phone, embedding its desktop within a window on your PC. Shouldn't you already have those files on your

Although you can tweak it as you'd like, the Start Menu in my test version of the Anniversary Update went very heavy on the suggested apps.





PC? That's not adding much to the experience, in my book. Connecting my phone to my Surface Pro 4 via Bluetooth was simple enough, but the connection lagged fairly severely. I poked through some photos, surfed the web a bit, then moved on.

Is the Windows 10 Anniversary Update worth it?

For anyone who already runs Windows 10, the Anniversary Update is here, like it or not. I hope Microsoft patches many of the random bugs that still remain, a few of which I noted in this review.

Meanwhile, millions of Windows 7 and Windows 8.1 users are wondering if they should follow Microsoft's lead. I suspect that little in the Anniversary Update itself will convince them to make the switch.

Windows 10's Connect app puts your phone's content within a window on your PC.

Far more important will be the hit to the pocketbooks of people who skipped the free upgrade to Windows 10, which expired July 29.

As stable and solid as Windows 7 is today, there simply must come a day when Windows 7 will become so outdated as to become nearly unusable. Meanwhile, Windows 10 introduced Cortana, Windows Hello, Task View, Edge, and the Action Center. To that, the Windows 10 AU

adds Windows Ink and buffs several existing Windows 10 features—worthwhile, certainly, but not the sort of monumental changes that Windows 10 originally introduced.

Has Windows 10 improved? Clearly. Does it still demand further work? Sadly, yes.

Microsoft promised us features such as using

Windows Hello to log in via the web, and it really ought to provide a full-fledged Ink experience with rich, editable text. Neither are here yet. Speech should be Microsoft's next priority—yes, you can talk to Cortana, but oral dictation should be a more prominent option than it is.

Cortana, biometric web authentication, data stored seamlessly in the cloud: These are bold strides forward, and ones that can potentially reshape the way we work and play. But they're unfinished. Windows 10 may be the last Windows, but these are still its first steps. 🛑



Once more for
old times' sake.

HP Chromebook 13: Google's Pixel has a rival for best Chromebook ever

BY MELISSA RIOFRIO

THE HP CHROMEBOOK 13 I'm reviewing just got a big compliment: "If HP doesn't want that back when you're done, let me know." That came from one of my coworkers, who uses a MacBook Pro. He admitted he was lured by the Chromebook 13's (go.pcworld.com/hpcb13) slender profile and brushed-aluminum sheen.

No doubt about it, HP made a beautiful-looking laptop that no one will mind showing off. The Chromebook 13 also very powerful, however, and that helps it outshine the similarly priced Dell



Watch the
video at
go.pcworld.com/hp-chromebk13vid

Chromebook 13 (go.pcworld.com/chromebk13rev) in speed as well as looks. The Acer Chromebook 14 (go.pcworld.com/chromebk14rev) looks similar and costs a lot less, but it can't match the HP Chromebook 13's performance.

As for Google's Chromebook Pixel (go.pcworld.com/chromebkpixel) flagship (specifically, the second-generation, 2015 model), the HP Chromebook 13 is its first serious competition. Our review unit, the third-highest of four SKUs, priced at \$819, performed on a par with the \$999 Chromebook Pixel in our tests, plus it has a higher-resolution display.

The only thing about the Chromebook 13 that might be less than outstanding is the battery life, which fell well below HP's spec in our tests, though it's still pretty good. If you didn't know before that device battery mileage may vary, here's yet another example.

Let's dive deeper into this new machine, which should have all other Chromebooks worried.

High-end design

HP says the Chromebook 13 is the slimmest in its class at just 0.51 inch thick, and it's light at just 2.65 pounds (not counting the 0.55-pound AC adapter).

HP's Chromebook 13 has a brushed-aluminum and magnesium shell.



HP Chromebook 13 G1

AT A GLANCE

HP's Chromebook 13 aims at the corporate user, with beauty and power to spare. It's the first Chromebook with a 3200x1800 QHD+ display and a Core m processor. All other Chromebooks should be worried, including the flagship Chromebook Pixel.

PROS

- Outstanding performance
- Gorgeous design
- Beautiful 3200x1800-pixel QHD+ display

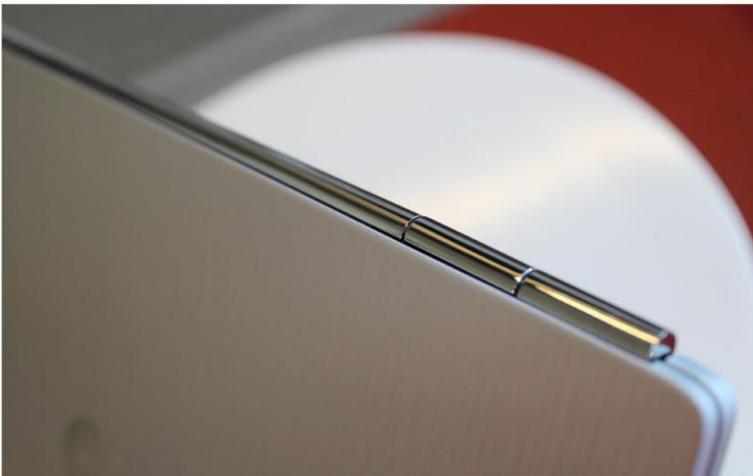
CONS

- Disappointingly drab bezel around the display
- Battery life falls far short of HP's spec in our tests





Top: HP's Chromebook 13 (left), side-by-side with Google's Chromebook Pixel (right). Both use aluminum in their shells for lightness and luster.



Bottom: The chrome-plated piano hinge on the HP Chromebook 13 is beautiful and very strong.

It has an aluminum-magnesium chassis with a brushed finish, and a swanky chrome-plated piano hinge that means your lid's edge stays well above your work surface.

Because the Chromebook 13 is so thin, HP had to build a little "chin" into the left side to accommodate a few ports: two USB-C and one USB-A (with the lower throughput of just 5Gbps (go.pcworld.com/usbtypecspeed) instead of 10Gbps, alas), plus the audio jack. On the other side is a microSD card slot (I'm sensing that good ol' SD card slots are on their way out).

The keyboard tray has a great-feeling, island-style keyboard and a

good-sized trackpad with a diamond-chiseled rim. A Bang & Olufsen speaker stretches over most of the top, just underneath the piano hinge, and delivers pretty good sound (albeit a little tinny).

The 13.3-inch IPS display offers a first for Chromebooks: QHD+ resolution (3200x1800 pixels), which is higher than the Google Chromebook Pixel's 2560x1700 resolution on its 12.85-inch display.

Almost needless to say, the image quality was as dazzling as the Pixel's. Note, however, that actually doing any work at this resolution could be frustrating, because icons and dialog boxes shrink to unreadable sizes.

Better to stick with what HP calls the Best resolution in the display settings, a much more readable 1600x900. That's also the resolution we used for all performance testing.

I have a couple of remaining questions about this display. First, why no touchscreen? HP says a touchscreen version will be available later this year (no doubt for more money and a little more weight). More

HP built a special, wider "chin" on the HP Chromebook 13's left side to fit a USB-A port along with two USB-C ports.





immediately, what's with the jarringly plain, black-plastic bezel around this beauty? The Pixel stretches the glass all the way to the edge for a seamless look. If that wasn't in the budget for the Chromebook 13, I'm surprised HP didn't at least spring for an aluminum-look plastic.

High-end performance

Before we talk about the HP Chromebook 13's performance, it's important to note that this is the first Chromebook product line to use Intel's 6th-generation Skylake (go.pcworld.com/skylake6thgen) processors—specifically, the Core m mobile chips. The lowest-end model, which starts at \$499, has the Pentium, while the other three models have core m3 (\$599), core m5 (\$819), and core m7 (\$1,029), respectively. Our core m5 SKU also comes with 8GB of LPDDR3 RAM and 32GB of eMMC storage.

These chips also allow the Chromebook 13 to be serenely fanless. In the course of testing I noticed some warmth under the upper left area of the keyboard, but not to an alarming degree.

A Bang & Olufsen

speaker runs almost the full width of the HP Chromebook 13's keyboard tray. The sound quality is pretty good.

For comparison I updated and retested the Chromebook Pixel, which has a 5th-generation (Broadwell) Core i5 5200U and has been our star performer. A look at these charts (HP's Chromebook 13 is the topmost in each) will show you why even the lofty Pixel needs to up its game.

The Cr-XPRT performance test measures Chromebook performance in basic productivity tasks as well as more demanding activities, such as watching movies or playing games. HP's Chromebook 13 finished in the lead—by a small margin—compared to the Chromebook Pixel. To be fair, both the Acer Chromebook 14 and Dell Chromebook 13 offer good performance for everyday tasks, even though they can't touch the HP Chromebook 13 or Google Chromebook Pixel.

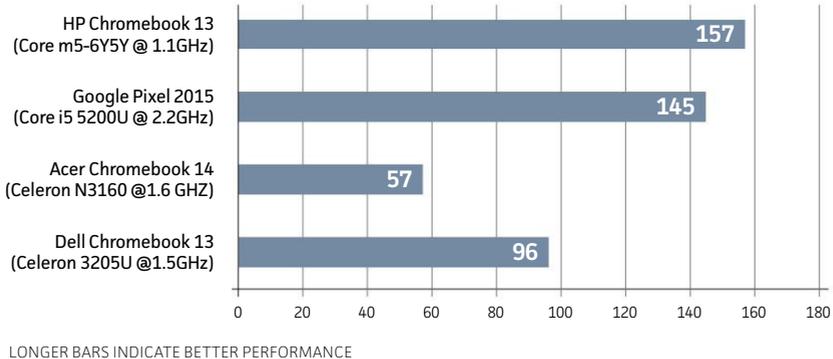
Google's Octane 2.0 JavaScript benchmark simulates advanced browser-based activities, including productivity applications, games, and interactive content. The HP Chromebook 13 came out ahead yet again.

The tables shift slightly in OortOnline, a WebGL test that focuses on graphics-intensive applications and games. Here, the HP Chromebook 13 falls slightly behind Google's Chromebook Pixel. While the difference is small, I ran some WebGL experimental animations on

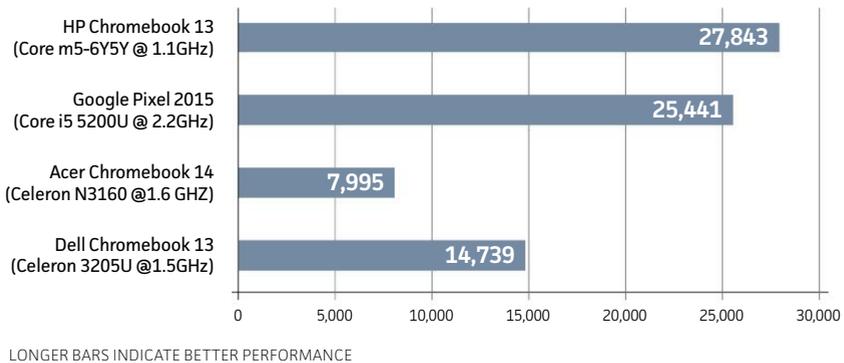


At left, HP's Chromebook 13 showing off 3200x1800 pixels, compared to Google's Chromebook Pixel (2nd generation) at right, maxing out at 2560x1700 pixels.

Cr-XPRT-2015 (general)



Octane 2.0 (JavaScript)



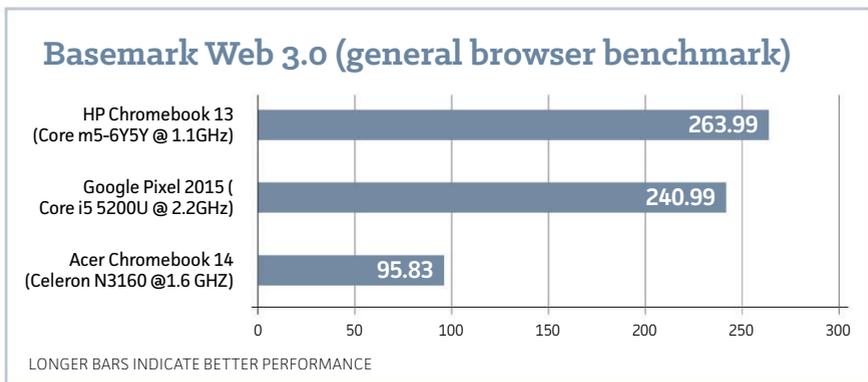
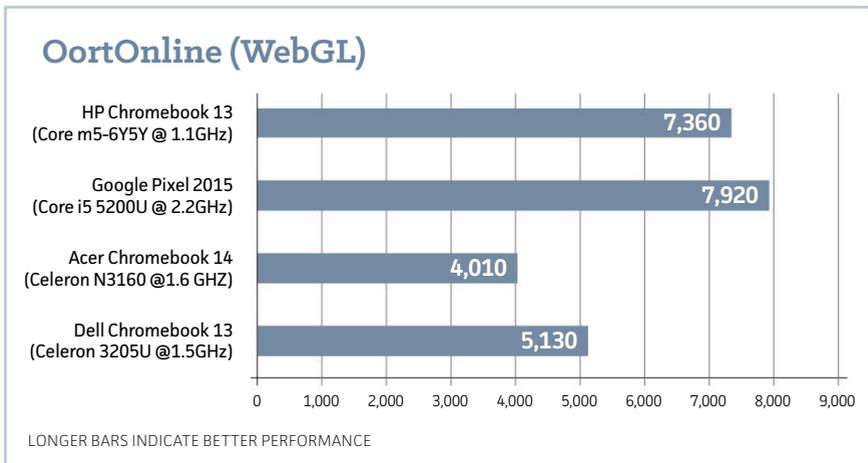
both the HP Chromebook 13 and the Google Chromebook Pixel. I noticed that the HP could sometimes get a little stutter in its renderings. The Chromebook 13 managed the more typical task of streaming movies just fine, though.

Basemark Web 3.0 recently replaced Browsermark 2.1 as Basemark's comprehensive browser benchmark. The tests cover web-based technologies including WebGL 1.0.2 and WebGL 2.0 real-time graphics,

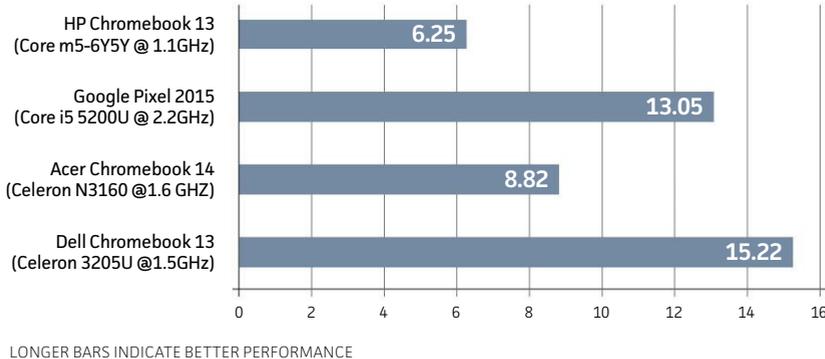
as well as JavaScript. The Chromebook 13 finished a nose ahead of the Chromebook Pixel and far ahead of Acer’s Chromebook 14. (Note: We couldn’t add the Dell to the Basemark chart, as it was tested with Basemark’s predecessor, Browsermark.)

Battery mileage may vary...a lot

Battery life is the one question mark on an otherwise outstanding laptop. HP says the Chromebook 13’s battery life will range from 8.75 to 11.5 hours with the QHD+ display on our unit. You know as well as



Cr-XPRT-2015 Projected Battery Life (hours)



we do that laptop mileage will vary. Still, assuming you're not cranking up the display brightness all the way or pushing the computer relentlessly, your battery life should be within the ballpark of what the vendor specifies. In our tests, using Cr-XPRT-2015's projected-life benchmark, we usually get pretty close.

In the case of HP's Chromebook 13, however, our results fell noticeably short in four out of five passes. The laptop has a 3-cell, 45Wh lithium ion battery. We set the laptop at or close to 200 nits' brightness and obviously start the test with a full battery. In one pass, it delivered a projected life of 8.13 hours. In all other passes, it ranged from 6 to 6.38 hours of projected life. On the same test, Google's Chromebook Pixel hit 13.05 hours, and Dell's Chromebook 13 was projected to last 15.22 hours. Six hours is pretty good, just not close to what HP promised. We've discussed our results with HP and will let you know if we learn more.

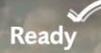
Even with this issue, HP's Chromebook 13 earns a very high rating. It's light, fast, and beautiful, and it costs a little less money than Google's Chromebook Pixel. It far outstrips corporate competition from Dell's Chromebook 13 and Acer's Chromebook 14. This is the new Chromebook to beat. 🔌

Make sure you

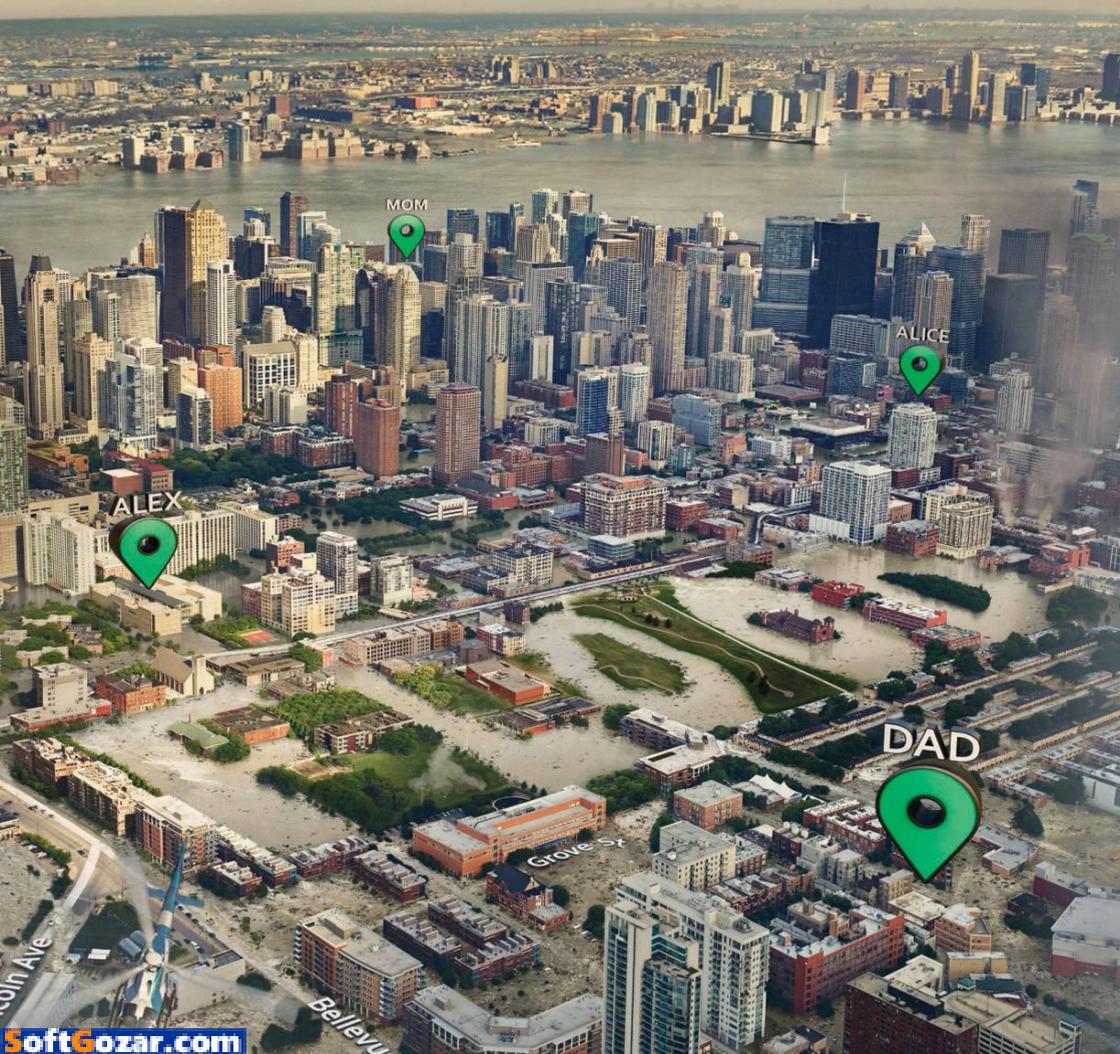
know where to find

your family

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Sapphire Nitro+ RX 480: Polaris rethought and refined

BY BRAD CHACOS

WHERE ARE THE CUSTOM CARDS?

The question's been reverberating throughout Internet forums and various subreddits since the launch of AMD's revolutionary \$200 Radeon RX 480 (go.pcworld.com/radeonrx480rev) graphics card. The chorus grew after weeks of radio silence on AMD's part; amplified when Asus revealed its Strix RX 480 (go.pcworld.com/strixxrx480reveal)



wouldn't be available until mid-August; and downright exploded into a cacophony when Nvidia's \$250 GeForce GTX 1060 (go.pcworld.com/geforcegtx1060rev) launched with a full complement of custom designs. Where are the custom cards? Well, here's a custom RX 480 card that AMD aficionados have been drooling for: Sapphire's Nitro+ RX 480. It's hitting online stores at \$219 for a 4GB model (go.pcworld.com/nitrox4804gb) (which we tested) and \$269 for an 8GB version (go.pcworld.com/nitrorx4808gb).

And yes—the war was worth it. Sapphire definitely put its own spin on AMD's Polaris.

Meet the Sapphire Nitro+ RX 480

All custom graphics cards build upon the foundation set by their underlying graphics processor. The Nitro+ RX 480 is no different—though its tweaks are major, extensive, and occasionally much-needed—so before we dive into the Sapphire card's specifics, take a quick look at the key specifications of the RX 480, the first graphics card built around AMD's cutting-edge 14nm Polaris GPU. (go.pcworld.com/4thgenpolaris) (See the next page.)

Got it? Good. Now let's talk about Sapphire's alterations.

The Nitro+ RX 480 ships in two configurations: A 4GB (which we'll be reviewing) and an 8GB model, both with a 256-bit memory bus. The differences between the two extend beyond mere memory capacity, however. The VRAM inside the 8GB model comes clocked at 2,000MHz, while the 4GB model runs at 1,750MHz.

The core clock speeds for the two models also differ. Both ship with a dual BIOS featuring both Quiet and Boost modes. The optional Quiet mode actually sticks to the same 1,266MHz boost clock as

Sapphire Nitro+ RX 480 (4GB)

AT A GLANCE

The 4GB Sapphire Nitro+ RX 480 delivers tremendous build quality, great performance, and thoughtful touches for a price that won't break the bank.

PROS

- Quiet, efficient cooler
- Astonishing build quality for the price
- Great 1080p and 1440p gaming performance
- Tremendous price to performance ratio

CONS

- Not overclocked much over reference RX 480



Radeon™ RX 480

GCN Architecture	4th Generation
Compute Units	36
Stream Processors	2304
Clock Speeds (Boost / Base)	1266 MHz / 1120 MHz
Peak Performance	Up to 5.8 TFLOPS
Memory Size	4/8 GB
Memory Bandwidth	224 GB/s or higher
Memory Interface	256 bit
Memory Type	GDDR5
Board Power	150W
AMD FreeSync™ Technology	Yes
DirectX® 12 Support	Yes
Vulkan™ Support	Yes
VR Premium	Yes
DisplayPort Version	1.3 HBR / 1.4 HRD Ready

the reference RX 480. The default Boost mode comes enabled out of the box, hitting a modest 1,306MHz on the 4GB Nitro+ RX 480 and 1,342MHz on the 8GB version.

Some Internet commenters were hoping for 1,400MHz clock speeds from custom RX 480 variants, which clearly didn't happen here (or on any of the other custom RX 480s announced thus far). That said, the 1,342MHz boost clock on the 8GB Nitro+ RX 480 is higher than the overclocks squeaked out of many early RX 480 reference models. Reference cards capable of hitting 1,330MHz—a mere 5-percent boost—appear to be a slim minority. And Sapphire spent time tweaking the Nitro+ RX 480's settings so that the card stays right near that maximum clock speed damned near 100 percent of the time that you're playing games.

Flipping on Boost mode also increases the power limit for the card, which is necessary as Polaris' performance ties heavily into the amount of power it's being fed. Don't fret about whether potential power consumption issues (go.pcworld.com/radeonrx480power) will

fry your motherboard, though. First off, AMD's already released a driver that fixed the reference RX 480's excessive PCI-E power draw (go.pcworld.com/radeonrx480fix) while simultaneously boosting performance.

Second, Sapphire redesigned the power system on the Nitro+ RX



The Nitro+ RX 480 features Sapphire's superb Dual-X cooling solution, with easily removable fans.



LED colour modes	Function/State
SAPPHIRE Corporate Blue	Static Blue
Rainbow	Phasing Colours
PCB Temperature Indicator	<ul style="list-style-type: none"> < = 60°C slow breathing blue (6 secs) > 60°C < 70°C mid-slow breathing light purple (3 secs) > 70°C < 80°C mid-slow breathing deep purple (3 secs) > 80°C faster breathing red (2 secs)
Fan Speeds	<ul style="list-style-type: none"> 0 ~ 200rpm slow breathing blue (6 secs) > 201 < 1000rpm mid-slow breathing light purple (3 secs) > 1001 <1500rpm mid-slow breathing deep purple (3 secs) > 1501 rpm faster breathing red (2 secs)
Customized LEDs	End user can customize the colour. Static State.
LEDs off	

480, swapping out the reference model's 6-pin power connector for a beefier 8-pin and altering the power phase design so that no more than roughly 60 watts courses in via your motherboard's PCI-E slot. The Nitro+ also features a new version of Sapphire's black diamond chokes, which help to filter and clean up the card's electrical signals. Sapphire says the new chokes reduce coil temperatures by an additional 15 percent compared to the ones found in previous Nitro cards.

Sapphire's supremely powerful, yet whisper-quiet custom coolers never fail to impress when I lay my hands on a Nitro card (go.pcworld.com/nitror9furyrev), and the Nitro+ RX 480 is no exception. The card features Sapphire's Dual-X cooling solution (go.pcworld.com/dualxcooling), a pair of fans over a beefy, high-density heat sink riddled with copper heat pipes of various sizes. The Nitro+ RX 480's fans have been upgraded to 95mm, dual ball-bearing models. Sapphire claims the

redesign results in a 10-percent noise reduction compared to the previous generation of Dual-X coolers. The fans actually won't spin at all until the GPU temperature hits 52 degrees Celsius, making the card completely silent when you aren't gaming or rendering videos.

It's easier to service and replace the Nitro+ RX 480's fans, too. They're held on by a single screw, and you don't need to rip apart the whole shroud to yank them all. What's more, a new Fan Check function in Sapphire's Trixx 3.0 software monitors your fan for issues and waves when problems come up. And if problems do come up, Trixx will connect you with Sapphire's customer service, which will send you a fan replacement rather than requiring you to send your entire card back for repair. Yay to eliminating life's little hassles!

Trixx 3.0 also powers Nitro Glow, Sapphire's branding for the multicolored RGB lights embedded throughout the Nitro+ RX 480. By default, the card glows Sapphire blue, but Trixx 3.0—which will be





“available soon,” so I didn’t have a chance to test it—allows you to set custom colors, tie the hue to various use states, or even shut it off completely.

Alternatively, pressing the LED button on the top of the card cycles through the options listed on page 5, no additional software required.

Speaking of the aesthetics, the Nitro+ RX 480’s pockmarked dark shroud looks absolutely sleek and gorgeous despite being hard plastic. It’s a refreshing change from the aggressive, angular, overly large (and borderline garish) designs deployed by many graphics cards these days. A sexy metal backplate on the rear of the card—which you don’t often see on mainstream graphics cards—makes it even more attractive.

Sapphire also tweaked the RX 480’s connectivity. While the reference board packs a single HDMI 2.0b and a trio of DisplayPort 1.4 connections, the Nitro+ RX 480 cuts the DisplayPorts back to two in order to squeeze in a second HDMI port as well as a DVI port. The latter will come in handy on lower-end monitors, while the extra HDMI port allows the Nitro+ RX 480 to output to both a monitor and a VR headset. Sapphire’s decision to swap out an extra DisplayPort in favor of those two connectors seems smart indeed considering the RX 480’s budget-friendly price and its position as the cheapest VR-ready graphics card around.

The Sapphire Nitro+ RX 480’s backplate.

All those new connection technologies allow Sapphire's card (and all RX 480 models) to drive 4K displays at 60Hz over HDMI. The DisplayPorts, meanwhile, can drive 1920x1080- and 2560x1440-resolution monitors at 240Hz, 4K displays at 120Hz, and even 5K displays at up to 60Hz—though the card only offers compelling gameplay at 1080p and 1440p resolutions.

The Nitro+ RX 480 also enjoys the rest of the Polaris GPU's technological benefits (go.pcworld.com/radeonrx480rev), such as the superb in-driver Radeon WattMan overclocking tool (go.pcworld.com/wattmanoverclock), dedicated asynchronous shader hardware for improved performance in DirectX 12 and Vulkan games, advanced video encoding/decoding for up to 4K/60 frames per second streams, and support for high-dynamic range video.

Basically, Sapphire left no part of the reference RX 480 untouched. But what do all those tweaks mean when it comes to actually playing games? Let's dig in.

Next up: System details and Division performance results. 

Continued: **Sapphire Nitro+ RX 480**



Sapphire Nitro+ RX 480: Polaris rethought and refined

BY BRAD CHACOS

AS ALWAYS, WE TESTED the Sapphire Nitro+ RX 480 on *PCWorld's* dedicated graphics card benchmark system (go.pcworld.com/pcwbenchmark), which is loaded with high-end components to avoid potential bottlenecks in other parts of the machine and show unfettered graphics performance. Key highlights of the build:

- Intel's Core i7-5960X (\$1,016 on Amazon go.pcworld.com/amzi75960x) with a Corsair Hydro Series H100i closed-loop water cooler (\$97 on Amazon go.pcworld.com/amzcorsaircooler).
- An Asus X99 Deluxe motherboard (\$360 on Amazon go.pcworld.com/amzasusx99).
- Corsair's Vengeance LPX DDR4 memory (\$65 on Newegg go.pcworld.com/nwegcorsairveng), Obsidian 750D full-tower case (\$155 on Amazon go.pcworld.com/amzobsidian750d), and 1,200-watt AX1200i power supply (\$308 on Amazon go.pcworld.com/amzcorsairax1200i).
- A 480GB Intel 730 series SSD (\$248 on Amazon go.pcworld.com/amzintel730)
- Windows 10 Pro (go.pcworld.com/win10pro) (\$199 on Amazon go.pcworld.com/amzwinprodrive)

We're comparing the \$220 Nitro+ RX 480 (4GB) against AMD's reference \$240 RX 480 (8GB), Nvidia's \$300 GeForce GTX 1060 Founders Edition (which essentially performs on a par with a \$250 GTX 1060 reference card), and the same rivals we used in our reviews of those two cards. EVGA's GTX 960 SSC, VisionTek's Radeon R9 380, and Sapphire's Radeon R9 380X represent the last-gen crop of \$200-ish graphics cards. They don't hold a candle to the new generation. You'll also find results for more potent options that the GTX 1060 more directly compares to: the Sapphire Nitro R9 390, EVGA GTX 970 FTW, MSI Radeon 390X Gaming 8GB, and the reference Nvidia GTX 980.

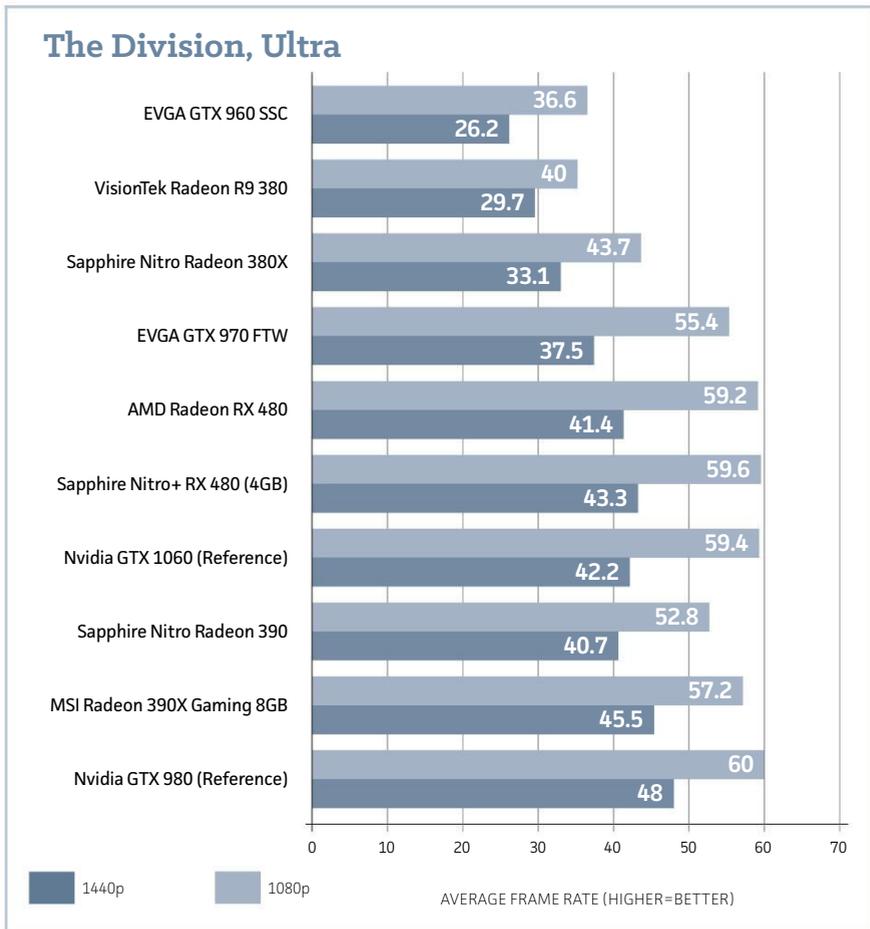
We benchmark every game using the default graphics settings unless otherwise noted, with all vendor-specific special features—such as Nvidia's GameWorks effects, AMD's TressFX, and FreeSync/G-Sync—

We benchmark every game using the default graphics settings unless otherwise noted, with all vendor-specific special features—such as Nvidia's GameWorks effects, AMD's TressFX, and FreeSync/G-Sync—disabled.

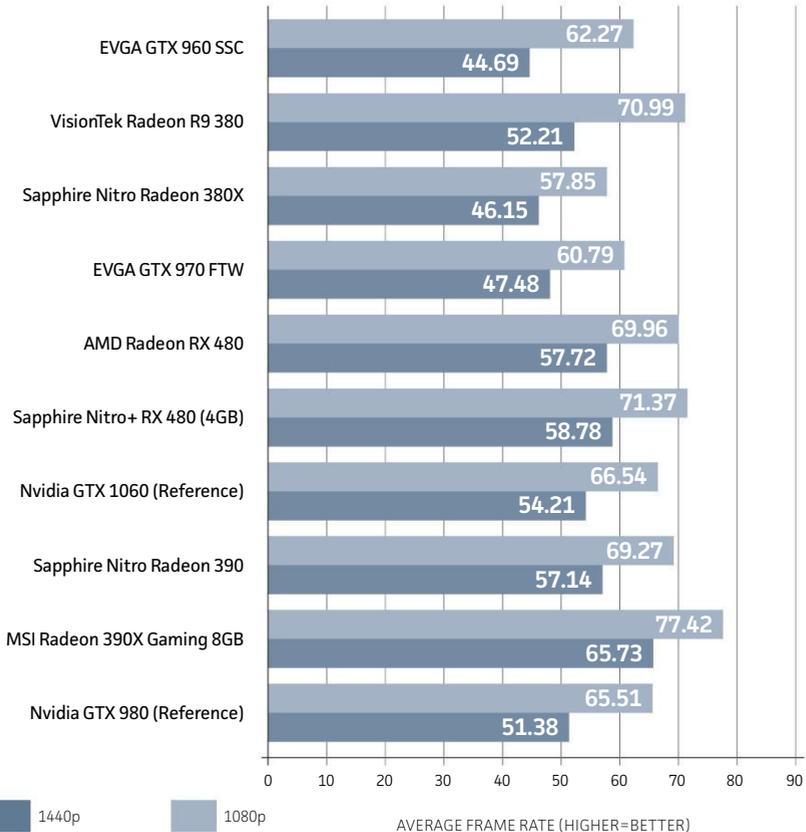
disabled. These cards can't really deliver a compelling 4K gaming experience, so we limited our testing to 1080p and 1440p resolutions.

Sapphire sent us a review sample very shortly before launch, so all tests were performed using the default 1306MHz Boost BIOS. Overclocking results have been added toward the end of the article.

But enough jibber-jabber! Let's see what an overclocked, custom-cooled RX 480 is capable of.



Hitman, ultra preset, DX11



The Division

The Division (go.pcworld.com/thedivision), a third-person shooter/RPG that mixes elements of *Destiny* and *Gears of War*, kicks things off with Ubisoft's new Snowdrop engine.

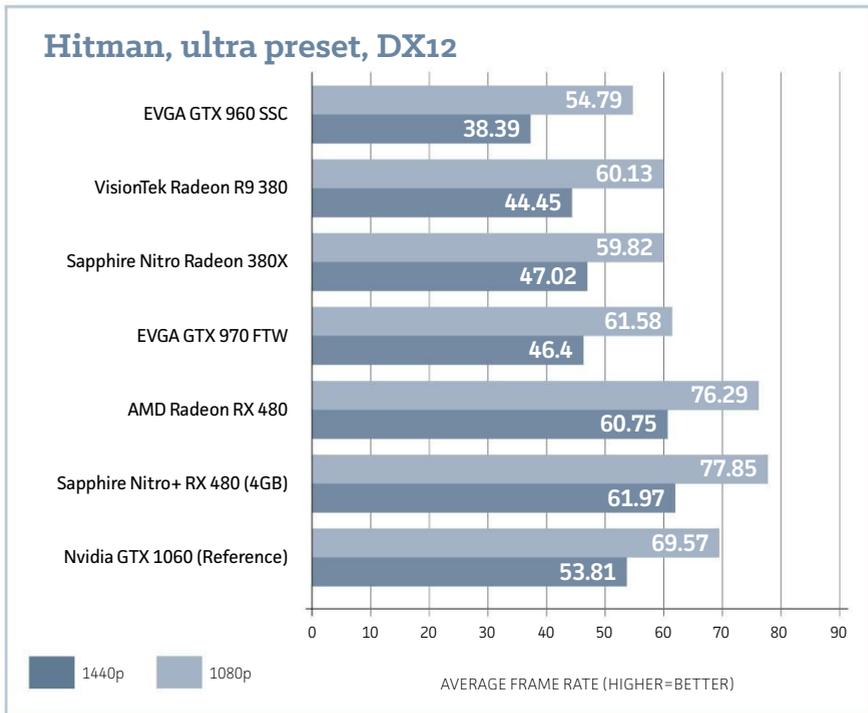
Here, we see the start of a trend we'll witness throughout the Nitro+ RX 480's review. The card's mild overclock doesn't push it much higher than the frame rates pumped out by the reference RX 480, but it does

enough to bring the AMD-powered card into parity with Nvidia's more costly GTX 1060 Founders Edition.

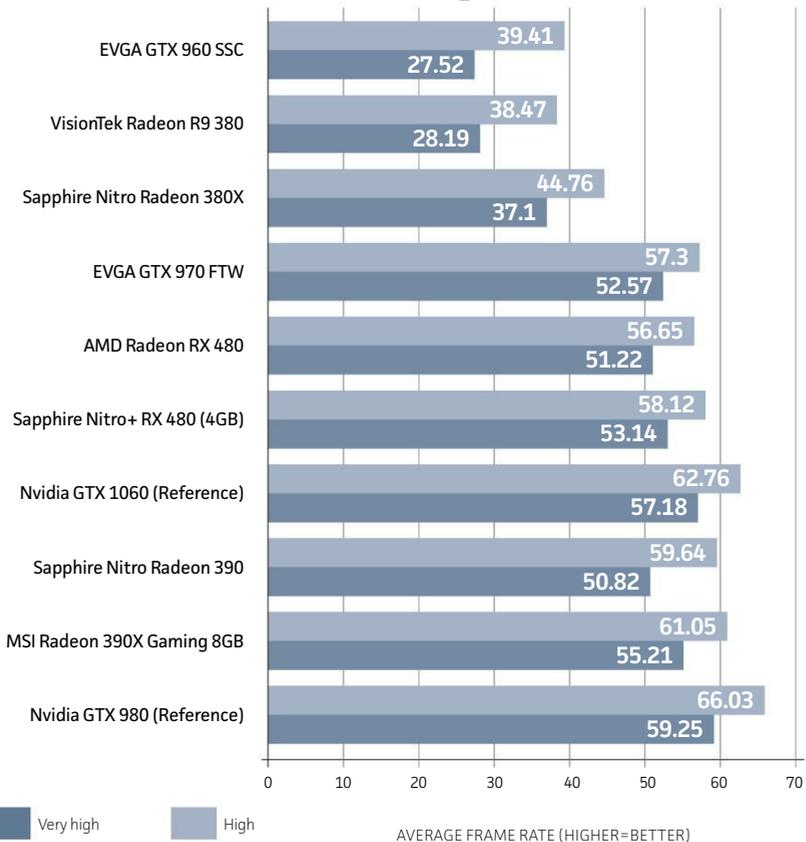
Hitman

Hitman's (go.pcworld.com/hitmanrev) Glacier engine heavily favors AMD hardware. It's no surprise; *Hitman's* a flagship AMD Gaming Evolved title, complete with a DirectX 12 mode that was patched in after the game's launch.

Important note: *Hitman* automatically caps the game's Texture Quality, Shadow Maps, and Shadow Resolution at medium on cards with 2GB of onboard memory, meaning the EVGA GTX 970 FTW and VisionTek R9 380 were tested at lower graphical settings. I've still included them in the graphs for two reasons: 1) because they're the \$200



Rise of the Tomb Raider, 1440p



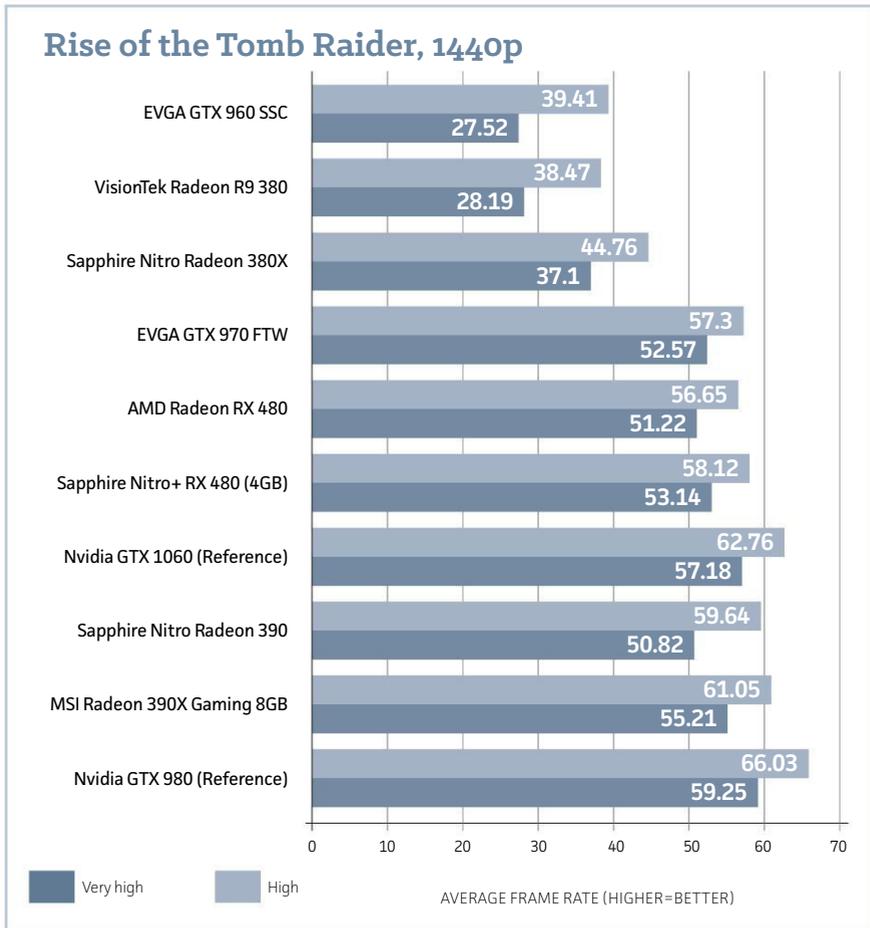
cards the GTX 1060 and RX 480 are directly replacing, and 2) so you can see the comparative DX11 vs. DX12 performance on those cards.

Nvidia's new Pascal GPU performs far better in *Hitman* than the older Maxwell-based graphics cards, but again, this game is built for Radeon. The Nitro+ RX 480's slight overclock only helps to widen the advantage between it and Nvidia's GTX 1060.

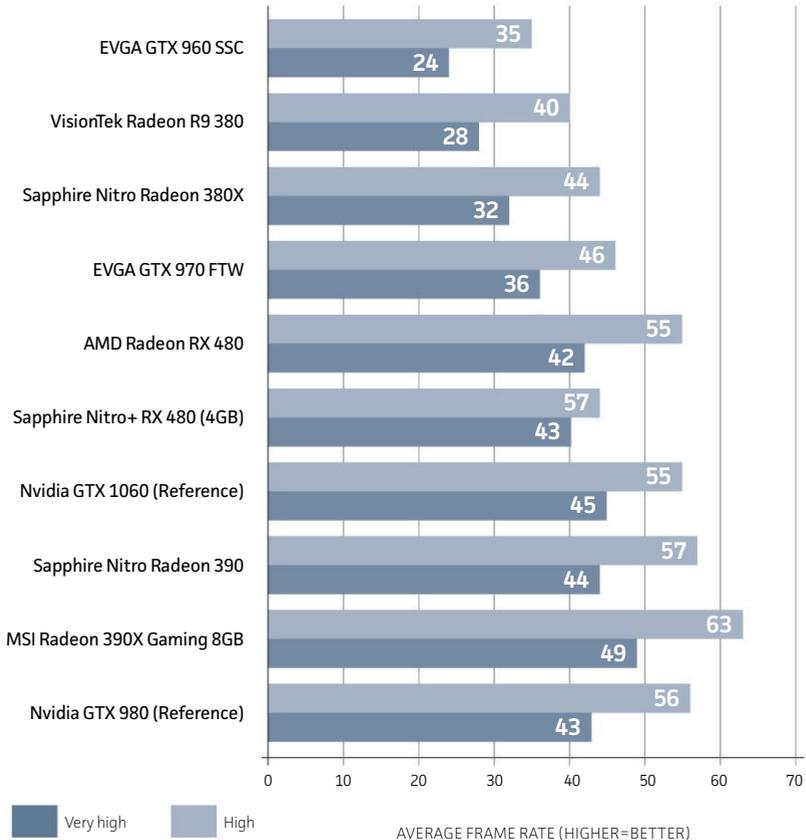
Rise of the Tomb Raider

Now for something completely different! Whereas *Hitman* adores Radeon GPUs, *Rise of the Tomb Raider* (go.pcworld.com/tombraiderpcrev) performs much better on GeForce cards. It's also the single most drop-dead gorgeous PC game I've ever laid my eyes on.

We only tested the games DirectX 11 mode, as we haven't had a chance to reevaluate the game's DirectX 12 enhancements now



Far Cry Primal, 1440p



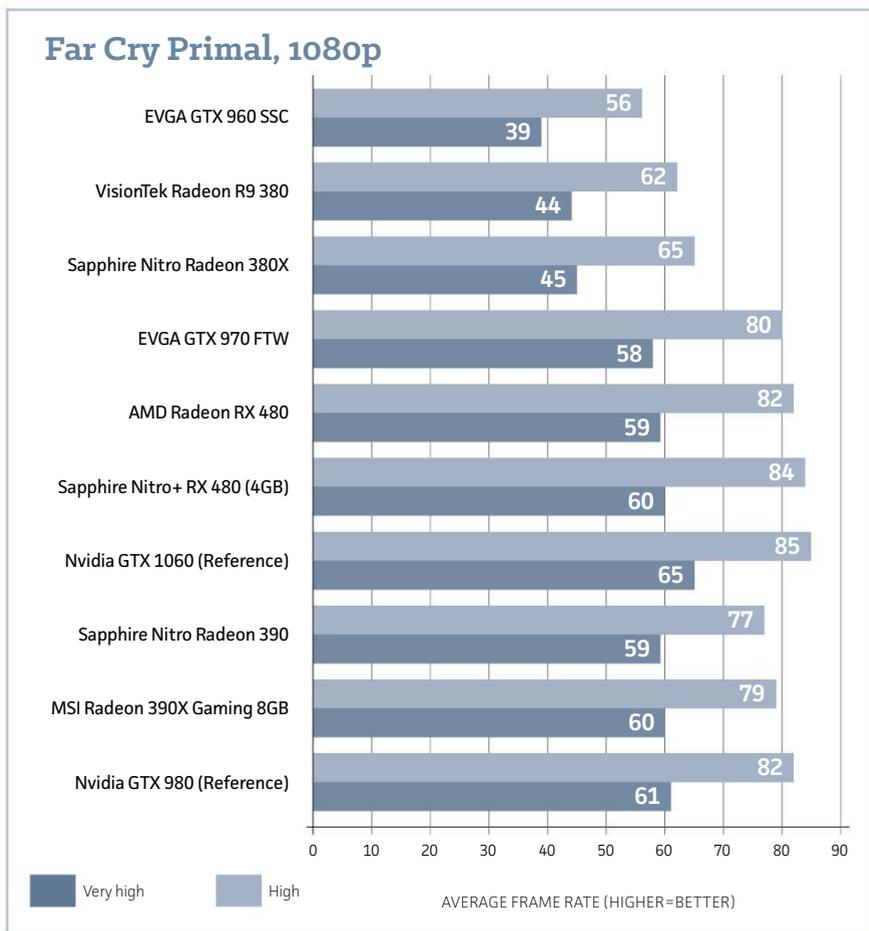
that several patches have been released to fix its once-wonky implementation.

The Nitro+ RX 480's overclock doesn't provide much of a boost here. The GTX 1060 still reigning supreme in this Nvidia-favoring game. That said, the Nitro+ RX 480 still delivers frame rates far in excess of the 60 fps gold standard with everything cranked at 1080p resolution, and comes damn close to it at 1440p, too.

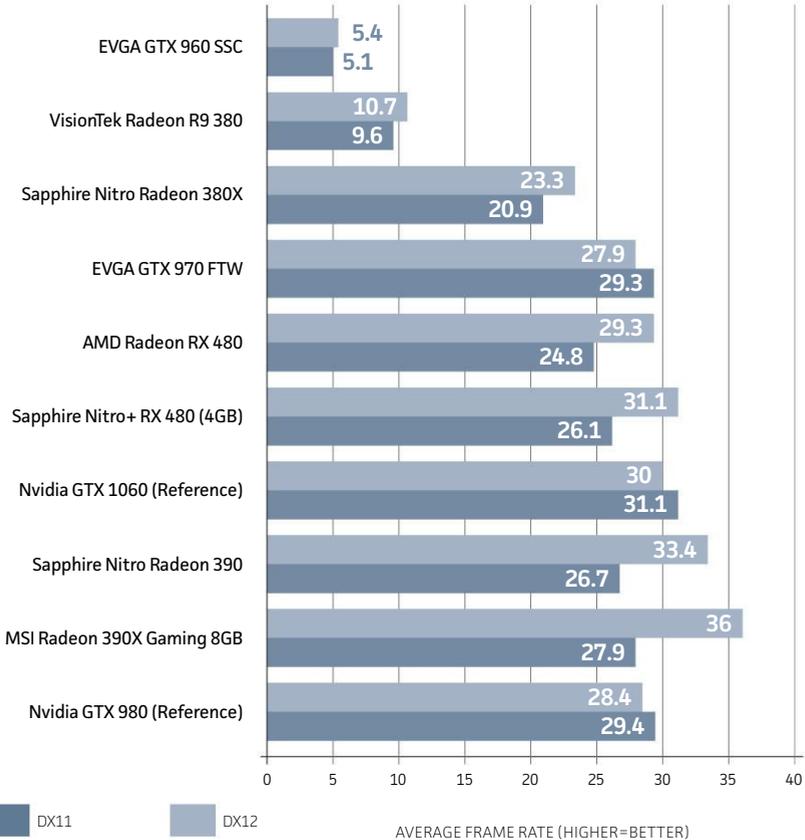
Far Cry Primal

Yes, *Far Cry Primal* (go.pcworld.com/farcryprimal) is yet another Ubisoft game, but it's powered by a different engine than *The Division*—the latest version of the long-running and well-respected Dunia engine. We test the game with the free 4K HD Texture Pack (go.pcworld.com/hdtexturepack) installed.

Up until this point we've compared the Nitro+ RX 480 against the



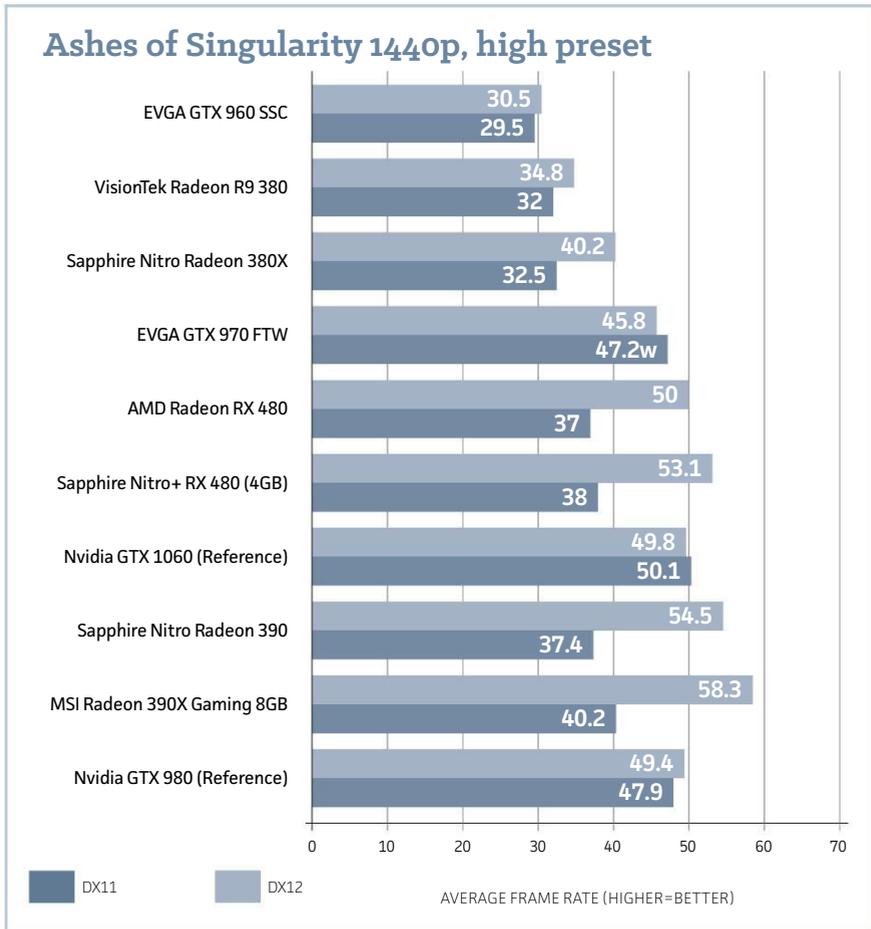
Ashes of Singularity 1440p, crazy preset



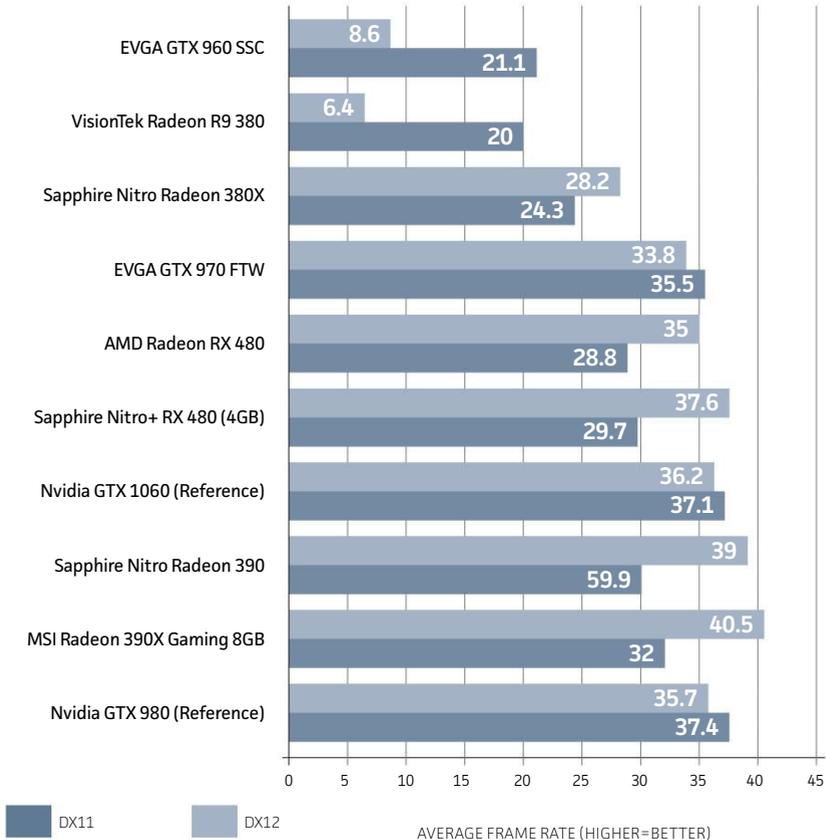
reference editions of the next-gen GPUs, and the narrative remains the same: The Nitro+ RX 480 is a little bit better than the reference RX 480 in *Far Cry Primal*, and closes the gap with Nvidia's GTX 1060. It seems like a good time to point how just how much more performance this new generation offers compared to the \$200 last-gen cards. The difference is night and day. You've never been able to play the most demanding new games at 1440p resolution on a \$200 graphics card—until now.

Ashes of the Singularity

Ashes of the Singularity (store.steampowered.com/app/228880), running on Oxide's custom Nitrous engine, was an early standard-bearer for DirectX 12, and it's still the premier game for seeing what next-gen graphics technologies have to offer. (It's a fun real-time strategy game, too!) The performance gains it offers with DX12 over DX11 are eye-opening—at least when running on Radeon cards.

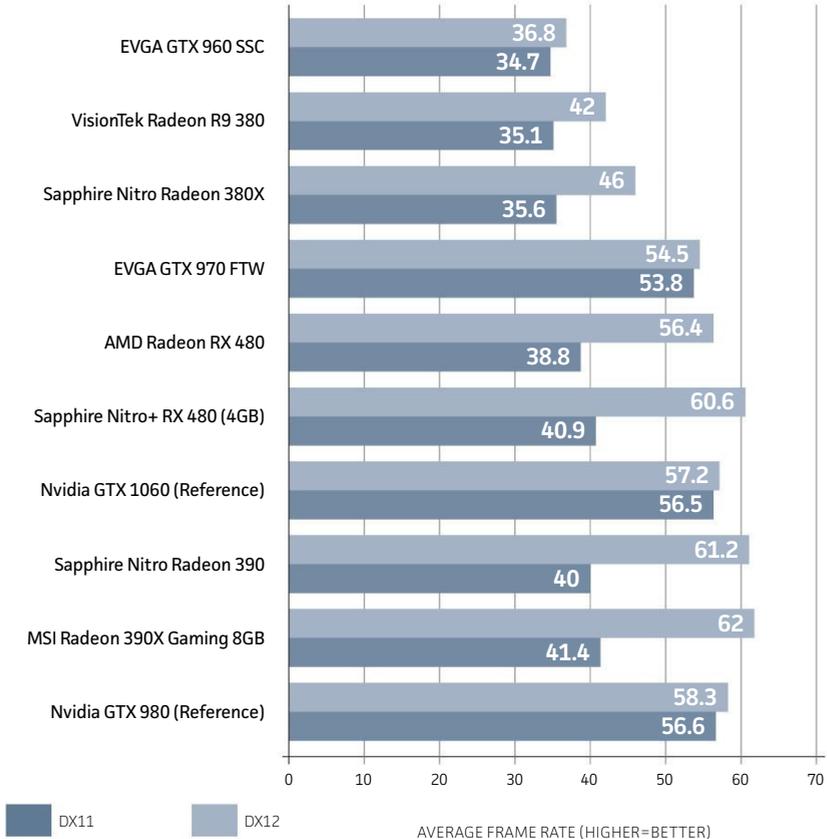


Ashes of Singularity 1080p, crazy preset



The most interesting tidbit here is the disparity in DirectX 11 vs. DirectX 12 performance. Nvidia's GTX 1060 absolutely blows away the RX 480 in DX11 in *Ashes*—but that difference is negated when you activate DX12 mode with Radeon cards, which provides a massive performance increase. All in all, the DX12 boost brings the RX 480 into performance parity with Nvidia's new card, and the Nitro+ RX 480's slight overclock gives it just enough extra juice to technically slip past

Ashes of Singularity 1080p, high preset



the GTX 1060. In reality, though, these cards are neck-and-neck in what you'll actually see on the screen.

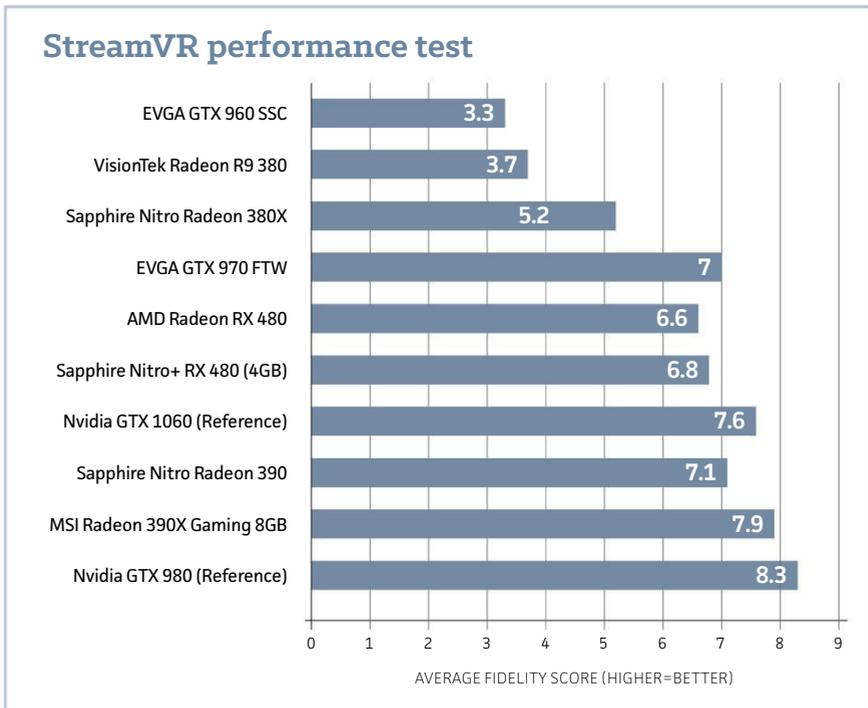
Next up: SteamVR performance and synthetic benchmarks 

Sapphire Nitro+ RX 480: Polaris rethought and refined

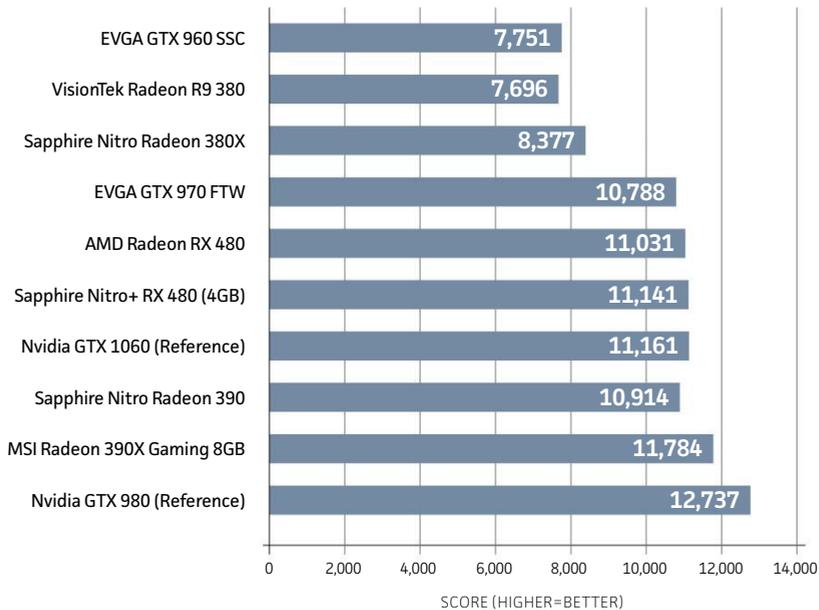
BY BRAD CHACOS

SteamVR and 3DMark

Time for some synthetic benchmarks! First up: The SteamVR performance test, which serves as the only major virtual reality standard until more benchmarking tools hit the streets. The SteamVR performance test is better thought of as a gauge for your graphics



3DMark Fire Strike, overall score



card's relative virtual reality performance—and as a pass/fail test for determining whether your rig can handle VR whatsoever—than it is for making head-to-head GPU comparisons.

The Nitro+ RX 480 clocks in with a higher average fidelity rating than the reference RX 480 and is definitely VR-ready, although it doesn't score quite as high as the pricier GTX 1060. That's not a big surprise, though, as Nvidia's cards score consistently higher across the board in the SteamVR performance test than AMD hardware does.

3DMark Fire Strike and Time Spy

We also tested the GTX 1060 and its rivals using 3DMark's highly respected DX11 Fire Strike synthetic benchmark, which runs at 1080p, as well as its brand-new Time Spy benchmark, which tests DirectX 12

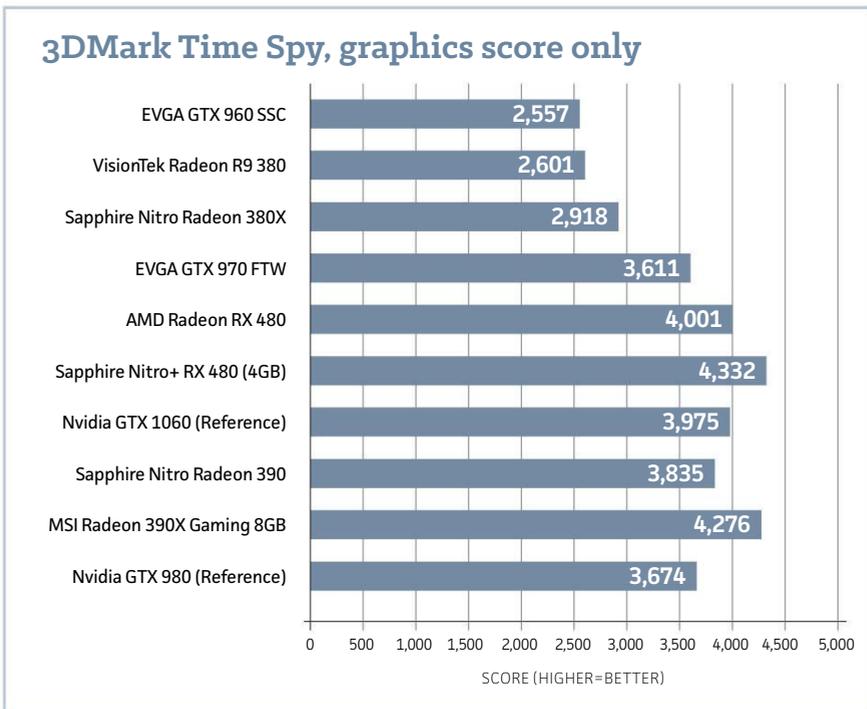
performance at 2560x1440 resolution.

Sapphire's Nitro+ RX 480 gets a healthy boost thanks to its mild overclock, bringing the card within spitting range of the GTX 1060 in Fire Strike and far surpassing both the GTX 1060 and the stock RX 480 in Time Spy.

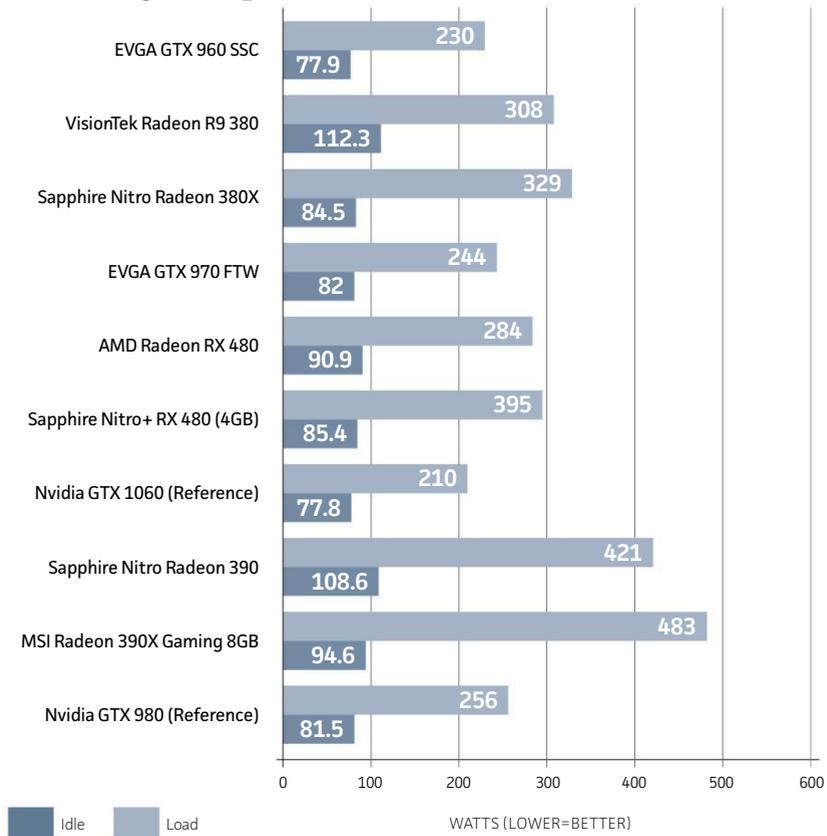
Power and heat

We test power under load by plugging the entire system into a Watts Up meter, running the intensive Division benchmark at 4K resolution, and noting the peak power draw. Idle power is measured after sitting on the Windows desktop for three minutes with no extra programs or processes running.

No surprise here: The overclocked, fan-laden Nitro+ RX 480 sucks down



Whole system power draw



slightly more power than the reference RX 480 under load. But that Dual-X cooler helps out when you're not playing games, as the Nitro+ RX 480 consumes a bit less power than its reference cousin at idle.

While the new Polaris GPUs give AMD a huge step up in power efficiency compared to last-gen Radeon cards—our system gobbled down an insane 400-plus watts with Radeon R9 390/390X cards comparable in performance to the RX 480 installed—Nvidia's GTX

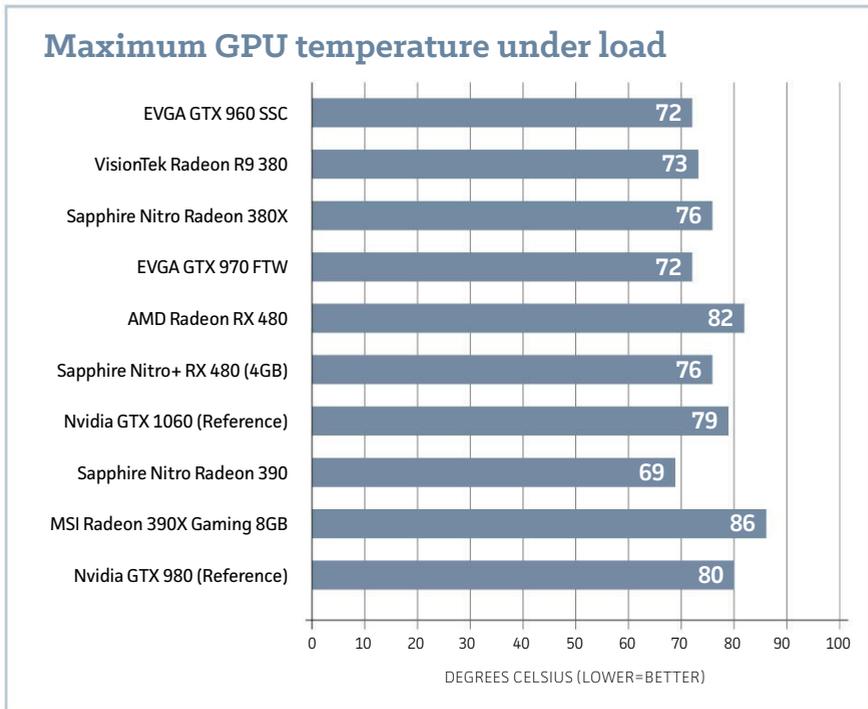
1060 is a power-sipping maestro. It draws less power under load than any other GPU we've ever tested.

Heat

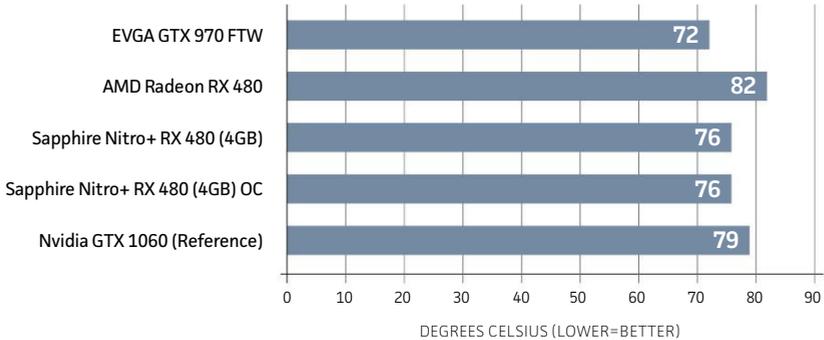
We test heat during the same intensive Division benchmark, by running SpeedFan in the background and noting the maximum GPU temperature once the run is over.

Many of the tested cards sport custom coolers, making this somewhat of an apples-to-oranges affair. Nevertheless, it's nice to see how Sapphire's Dual-X cooling solution compares to the reference RX 480 and GTX 1060.

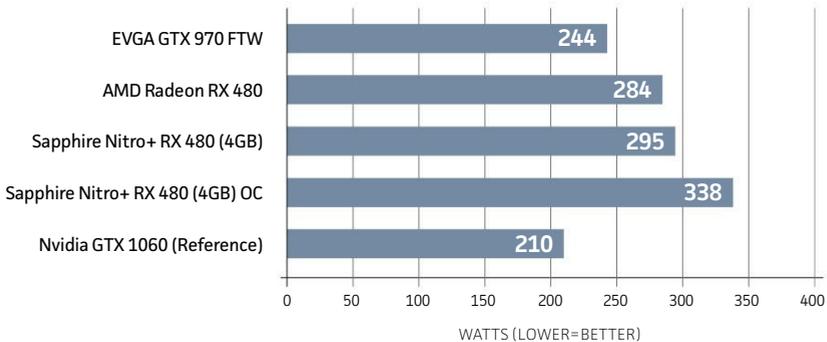
The Nitro+ RX 480 stayed nice and frosty even in extreme gameplay scenarios, never once going over 76 degrees Celsius. That's a



Maximum GPU temperature under load



Whole system power use under load



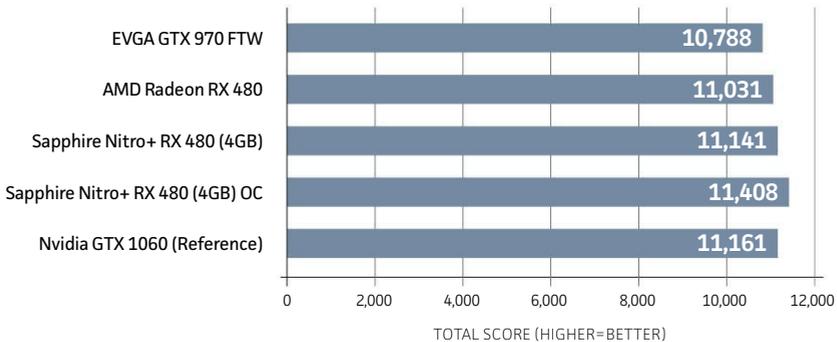
significant improvement on the stock RX 480's blower-style cooler, and a few degrees chillier than even the supremely power-efficient GTX 1060.

Even better: Sapphire's Dual-X cooler is again damned quiet in addition to being pleasantly effective. It's not quite silent, but anecdotally, I never once heard its fans over the test system's closed-loop liquid cooler for the CPU, which is itself pretty quiet most of the

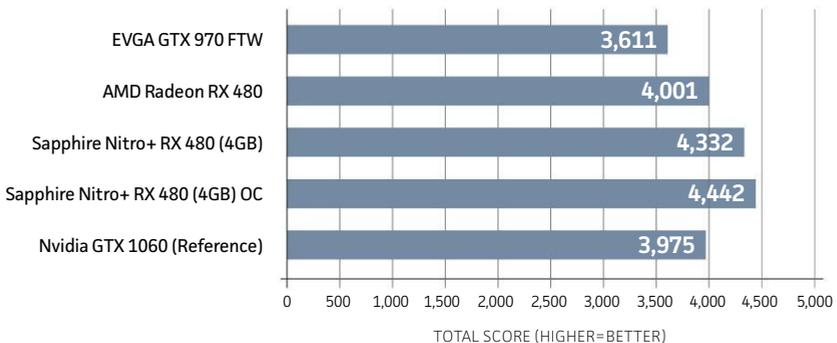
time. Sapphire's custom coolers continue to knock my socks off.

Okay, I lied. Once, and only once, the fans sped up to audible levels while running the *Rise of the Tomb Raider* benchmark, though exiting and restarting the run fixed the issue. I asked Sapphire representatives about it, and they said the problem stems from AMD's latest Radeon Crimson driver, which released just a few days back. Sapphire and AMD

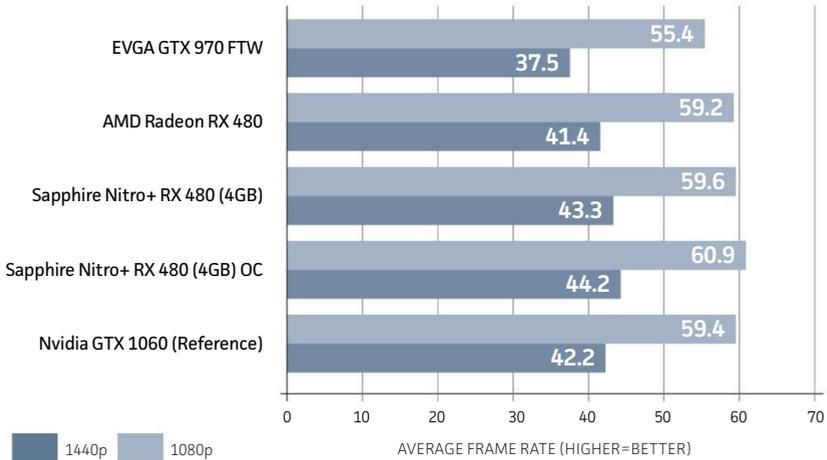
3dMark Fire Strike, overall score



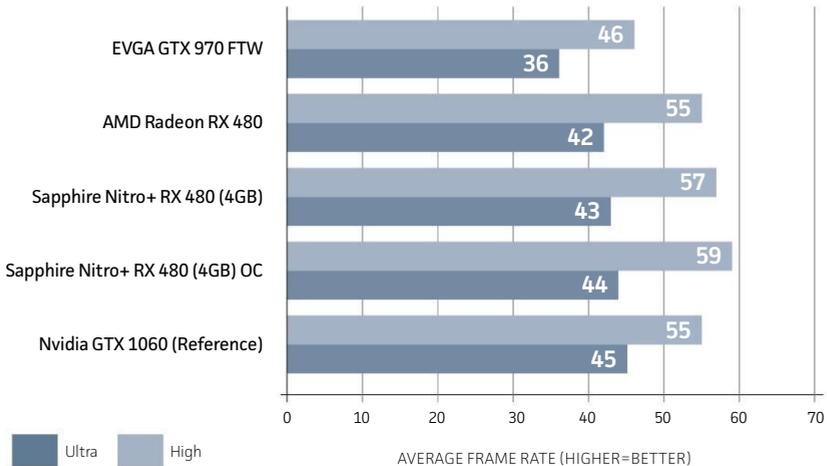
3dMark Time Spy, graphics score only



The Division, ultra preset

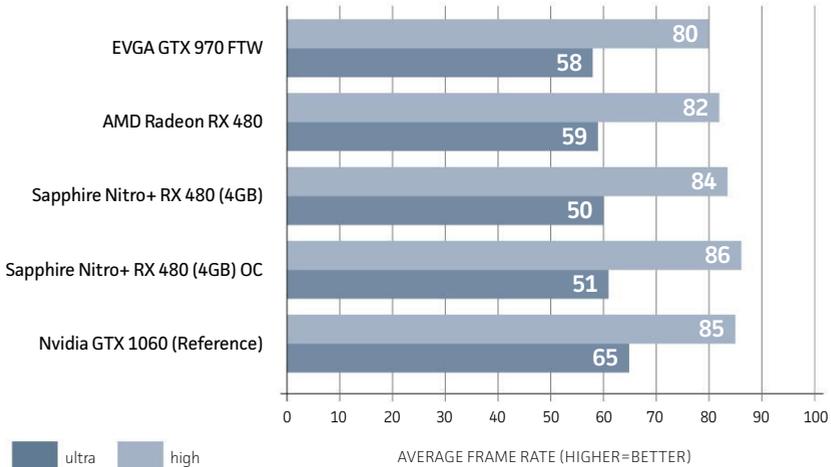


Far Cry Primal, 1440p



are working together to eliminate the issue shortly, Sapphire promised, and it shouldn't sprout up often. I wouldn't worry about it.

Far Cry Primal, 1080p



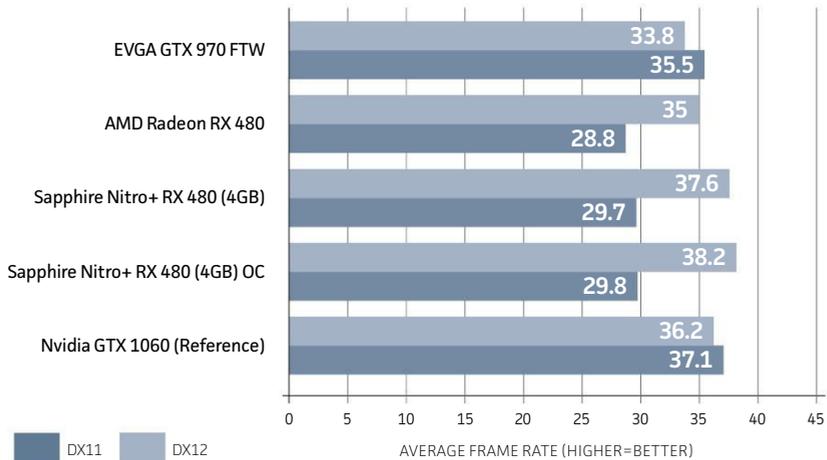
Overclocking

We didn't expect to be able to push the Nitro+ RX 480 much further, considering its meager out-of-the-box overclock—but we wound up pleasantly surprised. Using the WattMan overclocking tools (go.pcworld.com/wattmanoverclock) inside AMD's Radeon Crimson control panel, we were able to boost the card's power limit by 15 percent, its memory clock by an additional 100MHz, and its core clock all the way up to 1405MHz, which represents a 7.5 percent frequency increase over the Nitro+'s default 1306MHz max clock speed.

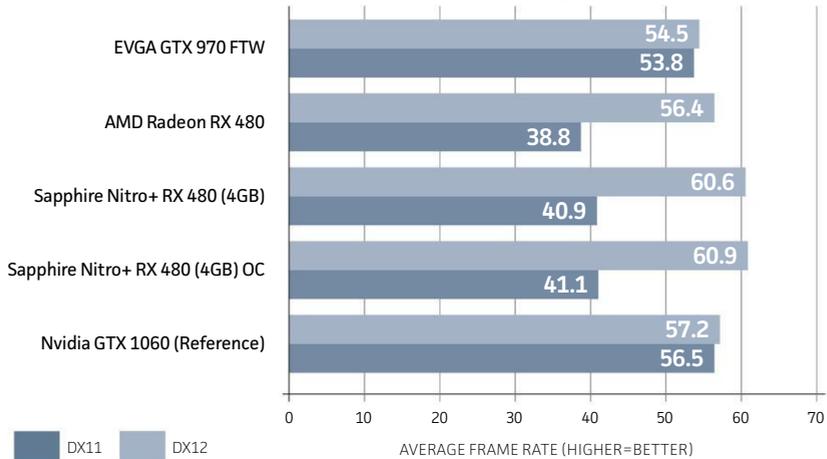
Doing so required cranking the fan speeds pretty high to avoid throttling. We set the max at 3,000 RPMs, which is definitely noticeable and definitely loud. Under load, they routinely spun at 2,800 RPMs or more, which helped keep the card running cool despite all the extra power coursing through its innards.

Now for the bad news: That epic (for Polaris) bump in clock speed still didn't result in massive performance increases, though there were slight improvements in the games and benchmarks we tested. (Note,

Ashes of the Singularity, 1080p, crazy preset



Ashes of the Singularity, 1080p, high preset



however, that we're comparing the 4GB Nitro+ against an 8GB reference RX 480, which not only has more memory, but faster

memory, too.) Seeing that, Sapphire's decision to keep the clock speeds lower (and thus, also keep the card cooler, quieter, and drawing less power) seems rational.

Bottom line

Simply put, the 4GB Nitro+ RX 480 is a stellar take on a revolutionary graphics card. Every aspect of Sapphire's card seems meticulously thought out. It's astonishing just how premium this card feels for its comparatively low price, especially considering it costs only \$20 more than reference RX 480s.

The programmable LEDs, attractive design, and metal backplate on the card helps Sapphire's card ooze quality and class. The returning Dual-X cooling system isn't quite as chilly as the insanely potent Tri-X system on pricier Sapphire models, but it keeps the Nitro+ RX 480



running cool while staying whisper-quiet the entire time. Even the altered port arrangement screams intelligent planning, replacing superfluous DisplayPorts with connections that buyers of a budget-friendly, VR-ready graphics card are more likely to actually need.

The only minor hiccup lies in performance. The modest out-of-the-box overclock in the 4GB

Nitro+ RX 480 simply doesn't move the needle much—though that limited overclockability seems to be more of a Polaris “problem” than a Sapphire one. It's also worth noting again that we're comparing a 4GB Nitro+ model against the 8GB

reference RX 480 in these tests, which sports not just more memory, but faster memory. I'd have like to compare models with similar memory capacities and speeds, but alas, that's just not how the review samples shook out.

That said, the minor speed increase provided by the Nitro+ RX 480's paltry 40MHz speed boost is enough to bring the card more in line with the GTX 1060's performance in our suite of games. Unless you need Nvidia's extreme power efficiency, there's little reason to buy a reference-edition \$250 GTX 1060 when Sapphire's superbly built Nitro+ RX 480 is available for \$30 less.

All Radeon RX 480s are a stellar option for anyone looking for a low-cost entry into VR, uncompromising 1080p/60fps gaming, or damned fine high-quality 1440p gaming. The Nitro+ RX 480 falls right in line with that general recommendation.

We'd recommend picking up a FreeSync monitor to go with the card if you're able, especially if you plan on 1440p gaming (in which case you might also want to consider the \$270 8GB Nitro+ RX 480 for both its larger memory buffer and its faster clock speeds). Variable refresh rate (go.pcworld.com/variablerefresh) monitors are magical: They

Unless you need Nvidia's extreme power efficiency, there's little reason to buy a reference-edition \$250 GTX 1060 when Sapphire's superbly built Nitro+ RX 480 is available for \$30 less.

make games feel buttery-smooth, drastically increasing your experience, and unlike Nvidia G-Sync monitors, FreeSync monitors don't carry much of a price premium. You can pick up a 22-inch 1080p FreeSync monitor for as little as \$130 on Amazon (go.pcworld.com/viewsonicvx2257), or a blistering-fast 144Hz 1080p FreeSync display for \$209 on Amazon (go.pcworld.com/aocg2460pf).

Final verdict

Again: Sapphire's \$220 Nitro+ RX 480 only costs \$20 more than the reference model, and at that price it's a hell of a steal. Taking in the gameplay boost, amazing build quality, and superb cooling solution, you'd be mad to opt for a reference edition of either the RX 480 or the GTX 1060 over this card. That might not necessarily hold true for the untested \$270 8GB version, which provides a heartier overclock but also falls firmly into custom GTX 1060 territory. But the 4GB model that we're reviewing here earns our unequivocal buying recommendation, especially if you're gaming on a 1080p monitor.

The 4GB Nitro+ RX 480 is a damned fine and damned affordable version of an absolutely amazing graphics card. Sapphire's setting the bar high for custom RX 480 models with this card's quality and price—especially if achieving sky-high overclocks continues to be a pipe dream with Polaris, thus limiting it to higher-end custom cards. 🏆

The 4GB Nitro+ RX 480 is a damned fine and damned affordable version of an absolutely amazing graphics card.



Nvidia's GeForce GTX 1060 is a \$250 GTX 980 killer

BY BRAD CHACOS

NVIDIA'S MORE MODESTLY priced graphics cards often roll out months after the more luxurious GeForce models. Look at the last generation: The GeForce GTX 960 (go.pcworld.com/nvidiagtx960rev) debuted four months after the GTX 980 and GTX 970 exploded onto the scene. A few generations before that, the GTX 660 launched a full half-year after the GTX 680.

But not the GeForce GTX 1060 (go.pcworld.com/geforcegtx1060).

Nvidia recently announced its new sweet-spot graphics card, a mere

month after the launch of the GTX 1080 (go.pcworld.com/gtx1080rev) and GTX 1070 (go.pcworld.com/geforcegtx1070rev), and hot on the heels of AMD's surprisingly powerful, shockingly cheap (go.pcworld.com/radeonrx480rev) Radeon RX 480—which no doubt spurred the speedy release.

And get this: The GTX 1060 is even faster than AMD's \$200 stunner and Nvidia's former \$500 flagship, the GTX 980, but still won't break the bank at \$250 (or \$300 for the pictured Nvidia Founders Edition go.pcworld.com/nvidiafoundersed).

Nvidia's new 16nm Pascal-based (go.pcworld.com/nvidiagp106) GP106 graphics processor beats in the heart of the GeForce GTX 1060. It packs 1280 CUDA cores—down from the GTX 1070's 1920—and builds upon the same engineering tricks that lets its bigger cousins hit insane clock speeds, boosting up to 1.7GHz when extra oomph is required.

Much like AMD's RX 480, the GTX 1060 can power the Oculus Rift and HTC Vive headsets despite its relatively low cost, and Nvidia loaded the card with memory to help maintain smooth frame rates in both virtual reality and demanding games played at 2560x1440 resolution. While the GTX 1060 doesn't utilize the cutting-edge GDDR5X found in the GTX 1080 (which costs \$600), the card features





6GB of GDDR5 memory clocked at 8Gbps. Nvidia’s new card sports the same HDMI 2.0b port and trio of DisplayPort 1.4 connections as the other GTX 10-series GPUs to ensure compatibility with VR headsets and ultra-high resolutions alike, along with a DVI-D (not DVI-I go.pcworld.com/ripvganvidia) port for lower cost displays.

Nvidia’s also maintaining its efficiency lead with the GTX 1060. While AMD’s 150-watt RX 480 essentially equaled the older GTX 970 in both performance and power draw—and pulled an excessive amount of juice (go.pcworld.com/radeonrx480fix2) from the motherboard to do so—the GTX 1060 sips a mere 120W over a single 6-pin power connection.

The GTX 1060 supports the same new bells and whistles as the higher-priced cards, including enhanced asynchronous compute features, simultaneous multi-projection, and the killer-looking Ansel 3D screenshot tool, which I personally can’t wait to try out as an enthusiastic Dead End Thrills-wannabe.

Nvidia made a couple of announcements on that end. Ansel made its debut in July with support added to *The Witcher 3* and *Mirror’s Edge*

Catalyst, two gorgeous open-world games that will no doubt showcase what the tool is capable of. Likewise, Nvidia's free Funhouse VR demo (go.pcworld.com/funhousevr) hit Steam in July, loaded with all sorts of Nvidia VRWorks tech. (Try shooting the water guns into the sky and catching the liquid on your face!) Nvidia plans to open-source the demo so that developers can make Funhouse attractions.

And yes, it'll all work on the GTX 1060. Many more games are working to integrate both Ansel and simultaneous multi-projection over the coming months.

A closer look at the GeForce GTX 1060

That's all the concrete info Nvidia's indulged, but the company dropped a GeForce GTX 1060 in my hands recently, and examining its physical construction reveals a few more interesting tidbits. For an even deeper dive into the design—inside and out—check out our GeForce GTX 1060 first look (go.pcworld.com/geforce1060look).

Similar to what we noticed with the RX 480's visual preview (go.pcworld.com/radeonrx480prev), the GeForce GTX 1060's circuit board is small—only about seven inches long, which is roughly equal to the RX 480's PCB and a mere inch longer than the remarkably tiny Radeon Nano (go.pcworld.com/radeonr9nanorev). That portends a potentially exciting future for itty-bitty mini-ITX GTX 1060 variants, especially since Gigabyte's already managed to cram (go.pcworld.com/miniitx





[gtx1070](#)) the more powerful GTX 1070 into a mini-ITX form factor.

Also like the Radeon RX 480, the GTX 1060's a full-length dual-slot graphics card despite its shrunken PCB. The final quarter of the card is pure fan and shroud—almost. Interestingly enough, Nvidia still slapped the 6-pin power connector on the end of the card's edge, and not on the PCB itself. That may make aftermarket water cooling tricky.

But more crucially, there aren't any connectors for Nvidia's fancy new SLI bridge (go.pcworld.com/nvidiaslc) on the GTX 1060. That probably has less to do with Nvidia's tightening of the multi-GPU belt (go.pcworld.com/nvidiamultigpu) than sheer economics. Dual GTX 980s outpunch the \$600-plus GeForce GTX 1080. If the \$250 GTX 1060 indeed outperforms the GTX 980, you'd be able to pick up a pair of them for just \$500—instantly undercutting the GTX 1080's market position despite the questionable future of multi-GPU support in games.

Here's what Nvidia's Bryan Del Rizzo said when I asked him about it:

“GTX 1060 delivers tremendous performance and power efficiency in its class.

“However, SLI was created to build the world's fastest gaming platforms, bar none—and squarely focused on enthusiast and hard-core gamers.

“In fact, very few gamers build SLI machines out of mainstream GPUs.

“With SLI we focused our efforts on creating the biggest and the best gaming PCs possible, using our high end enthusiast-class GPUs with our new high-bandwidth bridges.”

What's important here is what you don't see.

The lack of SLI may be a major bummer for enthusiasts, but it makes sense here given that Nvidia's offering the GTX 1060 for such a comparatively low price. AMD's \$200 RX 480 supports up to 4-way CrossFire setups (go.pcworld.com/amdmultigpu), however. It's worth noting that games built using DirectX 12 and Vulkan can opt to directly support multi-GPU setups, though.

Both the GeForce GTX 1060 Founders Edition and custom cards from Asus, Colorful, EVGA, Gainward, Galaxy, Gigabyte, Innovision 3D, MSI, Palit, PNY, and Zotac are now available.

The story behind the story:

The real question, though, is how much GeForce GTX 1060 stock will be available at the graphics card's launch. The GTX 1070 and GTX 1080 still suffer from crippling supply shortages more than a month after their respective launches, which Nvidia says is because it ramped up production faster than for any other GPU in the company's history. It certainly feels like AMD's \$200 RX 480 forced Nvidia into rushing up the GTX 1060's launch. Will you actually be able to buy one of Nvidia's new cards when they hit the streets? That's the million-dollar question. 🔌



Razer Blade (2016) : Incremental upgrades make it a good laptop for the moment

BY HAYDEN DINGMAN

ANOTHER YEAR, ANOTHER Razer Blade. Just swap out a few of the internals, tweak the design, and presto—you've got yourself a new-ish computer. Don't expect huge surprises or massive leaps in power. This here is what we call an "incremental upgrade."





Details, details, details

Most people won't notice or won't care about the kind of visible (and tangible) changes Razer has made to the 2016 Blade (go.pcworld.com/razerblade). At the very most, they're adjustments that might elicit a muttered "Ah, cool" as you read this. They include:

A new typeface: Razer made this update on its peripherals and the Blade Stealth (go.pcworld.com/bladestealthrev) earlier this year, and now it's come to the Blade. Gone is the heinous "gamer-friendly" typeface that Razer used to slap on its products. In its place is a lightweight sans serif that looks—dare I say it?—completely normal and inoffensive.

Changing up the typeface on the keyboard isn't the most amazing year-over-year change, but it's absolutely an improvement. It's probably the 2016 model's most notable aesthetic difference, too. Razer has always tried to position the Blade as a gaming-friendly MacBook, and now those comparisons seem even more apropos.

Oh, and it lights up. One more keyboard-centric change, and then I swear I'll be done: Like the Blade Stealth, the 2016 Blade features Razer's per-key Chroma lighting, aka 16.8-million color RGB. Is it completely unnecessary? Sure. Does it look nice? Sure.

USB-C: Okay, enough about keyboards. This year's Blade packs a Thunderbolt 3 USB-C port. However, the system still charges through a power brick with a

Razer Blade (2016)

AT A GLANCE

Razer's 2016 Blade is better and faster, but only just. This is an incremental upgrade as we sit and wait for Intel to release its Kaby Lake processors and Nvidia to let loose with GTX 10-series mobile GPUs.

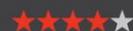
PROS

- Still one of the best performance/weight ratios going
- New, more subdued typeface
- Tweaked internals, including new cooling pattern

CONS

- The 970M is ooooooold
- Can get better performance at the same price if you sacrifice portability

\$2,000





conventional barrel plug. This is in stark contrast to the Blade Stealth, which charged with the USB-C cable only.

Me? I'm happy with this state of affairs, as I didn't love the USB-C charger on the Blade Stealth. It does make the Blade a bit less portable, though.

So what's the USB-C port for, if not charging the laptop? Presumably, it's for the Razer Core (Razer's external video card shroud)—provided you can get your hands on one. A handful have shipped to people who pre-ordered, and the next round ships at the end of August.

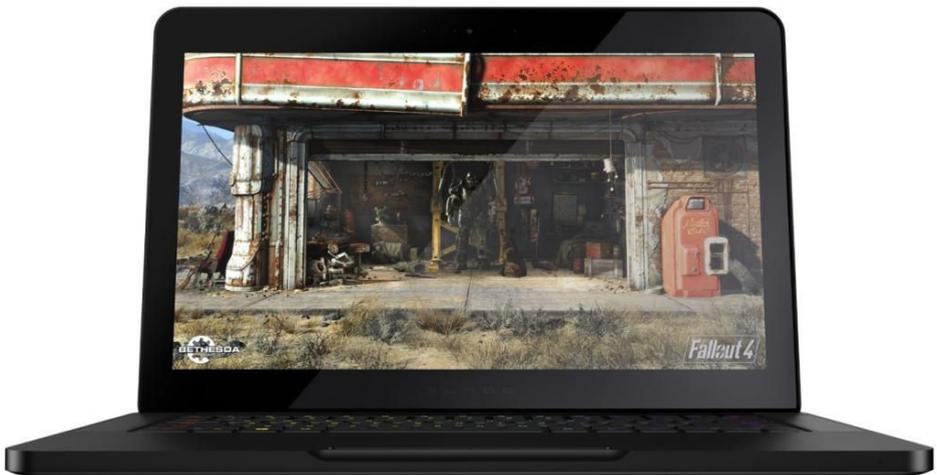
Of course, it's also a future-proof port, so expect to use it for all sorts of peripherals in the coming years. The Core is just Razer's big

USB-C selling point. In the meantime, you'll likely get more use out of the three USB 3.0 Type A ports, headphone jack, and HDMI port also on the Blade.

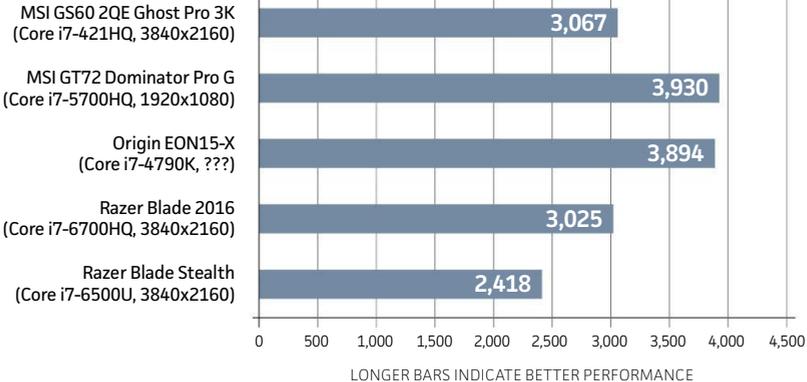
Cooling: This update gets into the nitty-gritty of “things most people wouldn't notice unless you told them”—Razer redesigned the cooling in this year's Blade to keep heat away from the keyboard. Why? Well, with past Blade models (go.pcworld.com/razerbladerev), the aluminum strip between the keyboard and screen would get hotter than the surface of the sun during gaming.

We didn't have a 2015 Blade around for comparison—so we're running a bit on faith here—but anecdotally, the 2016 Blade does seem better designed. Heat now appears to be contained in two main areas: the center of the underside, and then two key regions toward the center of that strip above the keyboard. And while it still gets uncomfortably hot, it doesn't reach the searing “cook an egg, or maybe just your fingertips” temperatures of previous Blades.

One weird side effect: Part of the keyboard now gets warm. Not hot, but warm. It feels strange when you first notice it. Also, the Blade gets loud and whiny when gaming. Tiny fans, high speeds. You've been warned.



PCMark 8 Work Conventional



The dull edge of progress

As for under the hood, the story is still one of small, expected steps forward. Inside, the 2016 Razer Blade sports a Core i7-6700HQ, Nvidia GeForce GTX 970M, and 16GB of RAM. You get a jump from a 4th-generation Haswell (Core i7-4720HQ) to a 6th-generation Skylake, and the 970M's RAM doubled from 3GB to 6GB, but the specs haven't changed wildly to something unexpected (or exciting). The system also now uses a PCIe SSD (instead of an mSATA SSD) for a bit of extra speed.

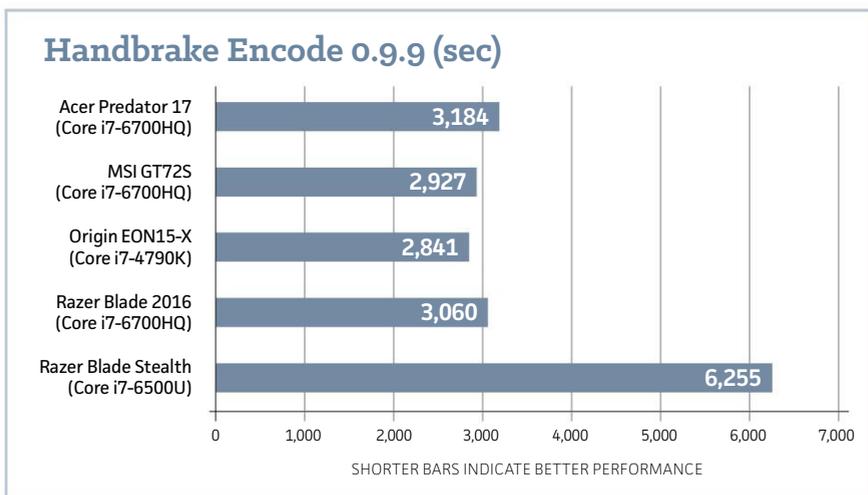
One note about that 970M: Don't expect to play high-end games on the Blade's 4K UHD screen with it. That said, the display itself is great for day-to-day desktop and browsing use. It's a bright, beautiful 3200x1800 IGZO panel with superfluous multitouch for people who like dirtying up their laptop screen. Color reproduction is surprisingly good even at wide viewing angles. The one downside is a ton of glare: A glossy panel is better for color, but you'll only be able to fully appreciate that fact in the dark.

The Blade is a solid performer, given its small chassis. In PCMark 8's Work Conventional test, which simulates office work like word

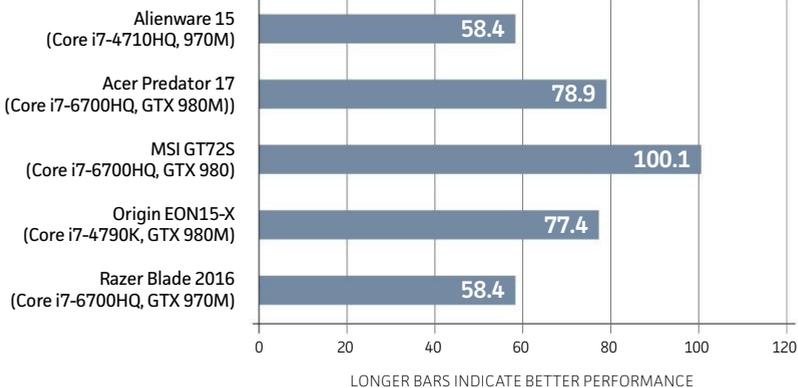
processing, video chat, and web browsing, the Blade scored 3,025. That number is lower than other systems with older quad-core mobile processors, probably because of the heat constraints of the Blade's compact dimensions. (The balancing act that a company must strike between heat, fan noise, and performance gets tougher the smaller the system.) Any score above 2,000 should be a solid experience for getting work done, though.

The quad-core Skylake does show up for battle in our encoding test, where we use Handbrake to convert a 30GB movie file to an mp4 using the Android Tablet preset. The test is all about the CPU, and here Blade finished its task in approximately 51 minutes. That's pretty damned good. By comparison, the much larger Acer Predator 17 with the same Core i7-6700HQ is slightly slower at 3,246 seconds, and the MSI GT72S (also a Core i7-6700HQ) squeaks out in front at 2,927. Both those laptops are much bulkier, I might add.

For gaming performance, the Blade posts typical 970M numbers. In fact, when benchmarking Tomb Raider on Ultimate settings and running at 1080p, we ended up with the same frame rate on the Blade (58.4fps) as an 970M-equipped Alienware 15 we tested last year.



Tomb Raider Ultimate Settings @ 1080p (fps)



That's all right, but it's not what you'd get from a GeForce GTX 980M. For example, Origin's 980M-equipped EON15-X managed 77.4fps in Tomb Raider at the same settings, and the Acer Predator 17 scored 78.9fps. Things are even bleaker if you compare the Blade to a laptop sporting a desktop 980, such as the MSI GT72S Dragon, which reached a whopping 100.1fps.

Why mention the 980, when the Blade is about half the size of any 980M- or 980-equipped laptop? Because if you buy this machine now, getting just a little under 60fps in a three-year-old game will seem even more depressing whenever Nvidia GTX 10-series mobile parts appear and wallop on every 970M, 980M, and maybe even laptop-sized 980 in sight.

This Blade is something of a stopgap release, though. Nvidia has still yet to announce anything official about GTX 10-series mobile parts, so at this point, really all Razer could do was to double the VRAM on the 970M, upgrade the processor, and put in a faster SSD. The good news is that this Blade is commensurately less expensive, given its older GPU. The 2016 model starts at \$2,000 for the 256GB SSD configuration, which is a couple hundred dollars cheaper than the

previous comparable version.

Bottom line

Sure, you can find a similarly spec'd laptop for a few hundred less, but not one that crams this performance into such an ultraportable form factor. Add in USB-C, the promise of the Razer Core, and that PCIe SSD? Pretty snazzy.

So if you need a laptop today, and can't wait for the 1070 to go mobile and start making its way into products, the 2016 Blade is a solid choice. Just be aware it's not a very future-proofed option at this point. 🛑

Xbox One S: The Xbox One moves into the 4K generation

BY MARK HACHMAN



IF YOU'RE A PC-first type of person, there's really only one reason to buy Microsoft's Xbox One S: You own or plan to own a 4K HDR TV, and want a relatively affordable but feature-packed media box to show it off.

As a gaming machine, the Xbox One S fills an awkward niche in Microsoft's lineup. At \$299 for 500GB of storage (go.pcworld.com/amzxbxone), it's \$50 more than the existing Xbox One for the same 1080p gameplay. Microsoft says the One S will upscale games to 4K, but this slimmer Xbox One will almost certainly be eclipsed in a year's time, when Microsoft's more powerful Project Scorpio (go.

pcworld.com/projectscorpio) and its promise of 4K console gaming launches holiday 2017.

But unlike Sony and its PlayStation 4 (go.pcworld.com/amzplaystation500gb), Microsoft has always seemed to think of the Xbox One as the living-room gateway to its software and services. Whether touting the system as an all-in-one media box or the best platform for console-exclusive games, the company tied the machine into the Windows ecosystem. In the Windows 8 era, Microsoft provided an app that let you control the console from your PC. With Windows 10, it dangled the lure of features like streaming from an Xbox One to a PC, with new ones continually in the pipeline for launch.

Microsoft has now pushed live its August update for the Xbox One—which some might call the equivalent of the Windows 10 Anniversary Update—and the One S is the first console designed to show off its new media support. This slimmer Xbox One might catch the eye, but being 40 percent smaller by volume than its predecessor isn't its strongest selling point. The compact design is meaningful, but not as much as the sparkling 4K content that the console can push to your TV.



Three generations of Xboxes: the Xbox 360 (left), the Xbox One S (center) and the Xbox One (right).

Microsoft Xbox One S 2TB Console - Launch Edition

AT A GLANCE

Microsoft's Xbox One S may be physically smaller than its predecessor, but it's essentially an Xbox One remastered for the 4K generation.

PROS

- Massive 2 TB Launch Edition should store most of your games
- Its 4K, HDR capabilities are perfect for the 4K generation
- Space savings with no apparent cooling issues

CONS

- Without a 4K TV, One S advantages go away
- Attaching the stand feels permanent, even if it isn't
- Next-gen Project Scorpio is little more than a year away

\$399





4K: The reason to buy the Xbox One S

After 3D TVs largely bombed, TV makers began selling consumers on the next big thing: 4K Ultra High-Definition (UHD) displays. To make them even more tempting, the newest TVs feature a new metric of visual quality—high dynamic range (HDR).

HDR is harder for me to appreciate without seeing a direct comparison with non-HDR content, but I sure can see the benefit of 4K. The additional resolution lends an air of reality that even 1080p lacks. More and more 4K content is finally becoming available, too, making it more worthwhile to upgrade. It's no longer just limited handfuls of Netflix series and YouTube videos, but you now can buy 4K Blu-ray discs as well. To take advantage of the latter, however, you need to buy a 4K Blu-ray player, and they're not cheap. Prices bounce around between roughly \$200 to \$400.

So the Xbox One S's support for both 4K Blu-ray discs, 4K streaming, and HDR make it seem inexpensive, especially given all of its other capabilities—much like how Sony's PlayStation 3 was generally thought of in the same light for the first Blu-ray discs in 2006. (Sony has announced plans for its own 4K, HDR-capable version of the PlayStation 4, but hasn't named a price or a ship date.) And that 4K content looks great on the screen, whether it's streamed from Amazon, Netflix, or YouTube, or played off a 4K HDR Blu-ray.

A scene in the 4K version of the movie *Star Trek* looks great, thanks to both the source media as well as the Xbox One S.

How much of a “Wow!” factor you’ll encounter will depend on what you watch—Microsoft provided a 4K Blu-ray of 2009’s *Star Trek*, but that film’s brown-and-orange palette didn’t do much for me despite looking sharp and detailed. Netflix and YouTube offered many more impressive moments, especially when viewing the sort of bright, vibrant nature videos that TV makers use to show off their new products.

The S will support games with HDR, incidentally. But the first ones with that feature—such as *Gears of War 4*, *Forza Horizon 3*, and *Scalebound*—are still some months away.

Microsoft’s Mike Ybarra has also said that the One S will upscale games to 4K resolutions—if it does, though, I saw no obvious indication of that in the One S I used for this review, even with a 4K, HDR-enabled display in the PCWorld.com labs. Keep in mind, though, that upscaling interpolates pixels, which is quite different than processing a game and textures specifically designed for 4K.



Fit for the living room

Unlike the original Xbox One, the One S actually looks like a media box that would fit comfortably in your existing living-room setup. It measures 11.63 inches wide (or tall, if mounted vertically), 9 inches deep, and two inches thick—the original Xbox One, on the other hand, is about 13 inches wide and 11 inches deep.

While that’s about 40 percent smaller by volume (as mentioned earlier), the One S comes with another bonus: the integration of the previously massive power brick into the system. It’s a welcome subtraction, and



makes the lighter weight of the One S (6.58 pounds, or about half a pound less than the original Xbox One) even more impressive.

Cooling appears to be a priority. The dimpled front panel lacks any obvious vents. If laid flat, however, both the sides and top include an ample grille of small holes, about the diameter of spaghetti noodles, above roomy cutouts. Although there appears to be what looks like a second grille inside, guarding some of the components, it'll be interesting to see how much cat hair and other gunk accumulates inside the One S over the course of its life. That said, in its clean state, the One S remained cool to the touch and without any apparent fan noise when tested in an air-conditioned house and office with ample airflow.

Microsoft has designed the One S to be stored vertically as well as horizontally. A low-profile stand, which comes included for free with the 2TB version, slides snugly onto one side of the console, with two plastic tabs that fit into small slots. Once it's on and the Xbox One is positioned vertically, the console should withstand a hip check to your entertainment stand—but perhaps not a disgruntled cat that's intent on “accidentally” knocking it off.

Speaking of the stand's snug fit: Once inserted, it certainly feels like a permanent decision. I had a very “oh crap” moment when I realized that my entertainment center is set up for a generation of horizontal DVD players and DVRs, rather than vases and cable modems. Microsoft says that the stand is removable, but the process is not for the faint of heart; it fastens very securely, so your best bet is to plan your entertainment console layout beforehand. It also seals off a whole side

The Xbox One S moves the One's third USB port to the front.

of the One S, although I have to imagine the system’s cooling scheme accounts for this—I played *Forza Motorsport 6* and *Grand Theft Auto 5* for at least an hour, and even with the stand connected, the One S felt cool to the touch. I never heard its fan.

On the rear of the One S are two HDMI ports, one in and one out from the TV, as well as a pair of USB 3.0 ports, SPDIF and ethernet, plus an IR-out port. On the front, there’s a third unmarked USB port for USB drives, a button to sync with the controller, an IR receiver, a power button, as well as a button to eject game discs. However, the One S lacks a dedicated Kinect port. Those who own a Kinect and are upgrading from the original Xbox One can ask for a free USB dongle (go.pcworld.com/xboxdongle) that can accommodate the Kinect. (Microsoft didn’t send us that dongle in time for this review, so we couldn’t evaluate how well it works.)

Besides altering the scheme from black-on-black to white with black accents, only very subtle changes differentiate the standard Xbox One controller from the one that comes with Xbox One S. They include a textured back that promises a better grip for sweaty hands, and a 3.5-mm audio jack in the front that allows you to easily plug in a headset or headphones. The new One S controller is also Bluetooth-enabled and can be used with a Windows 10 PC sans a dongle or cord.

Both controllers are otherwise virtually identical, though the One S controller feels slightly more “squished” from the side, perhaps in keeping with the compact feel of the One S. The shoulder buttons are

The rear of the
Xbox One S.



A subtle texture on the white One S controller helps sweaty palms grip the controller.



both less pronounced and firmer than the original Xbox One's controller, without quite as much travel distance and play.

A snappier interface... well, sort of

Gamers tend to fixate on frame rates, visual quality, and the graphics horsepower available to games on their console. But one of the shortcomings of the original Xbox One is much simpler: the lengthy boot time. My system currently requires a whopping 1 minute and 20 seconds just to actually load the main UI, and as much as 1 minute and 47 seconds before the standard notifications ("External storage ready") disappear. The One S required just 45 seconds.

However, if you compare that to a standard Surface Pro 4 running the Windows 10 Anniversary Update, 45 seconds seems like an eternity. The SP4 takes 20 seconds to launch from a cold boot, and just



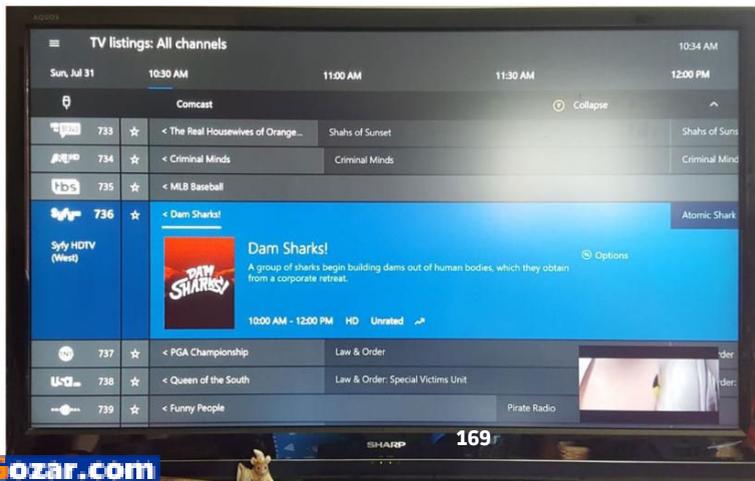
The Xbox One controller (left) versus the new Xbox One S controller (right).

3 seconds to resume from a sleep state. Clearly there's room for improvement here, and the fact that you can't (officially) swap out the internal hard drive for an SSD means that performance will still lag. Even if you were to go that route, switching to an SSD would inflate the price of your console while reducing the amount of available storage. (Unless you really have deep enough pockets to buy a 2TB SSD.)

Another issue is that the user interface itself seems to require time to "warm up." The first time you try to open up the left-hand sidebar interface, the system seemingly lags for a second or two. Using the shoulder buttons to navigate back and forth between the Dashboard's sections is satisfactory, though it seems that every so often the One S doesn't register a button click.

Once you're navigating around the Dashboard, other small irritations crop up. These stem from legacy UI design: When the Xbox One first launched, it came out of the gate as a living-room entertainment device. For example, you can let NFL game highlights play in a snapped window alongside OneGuide listings. The problem is, snapping is cumbersome if you don't use voice commands (either through a headset or Kinect), which is what the interface had originally been designed to use.

I never thought I'd say this, but my existing Comcast Xfinity X1 set-



The Xbox One S can serve as your interactive channel guide. With certain shows, you can see what people are saying about them on Twitter.



Cortana makes an appearance on the Xbox One S, though she's somewhat less useful than on the desktop.

top box provides a superior approach. Not only does the voice-equipped remote work better than Cortana (more on that later), but the X1 lumps all of its movies into one content bin, eliminating the need to download multiple apps. (I've used older AT&T uVerse and DirecTV UIs, though, and in competition with those, the One S may be superior for some people.)

I do like OneGuide's "trending" shows (which are handled better than how Comcast does it), and how Microsoft allows you to see tweets from people watching a given show. Fortunately, there's nothing precluding me from using my Comcast interface while otherwise using the Xbox One S as a gateway.

The Windows 10 advantage

With the emergence of Windows 10 and Microsoft's cloud services, it's not quite enough to talk about the Xbox One S as a stand-alone console, like the Nintendo Wii U. As part of the Windows 10 ecosystem, the Xbox One S (like the original Xbox One) can tap into apps like Microsoft's Edge Internet browser. It can also run UWP (go.pcworld.com/uwp) apps like Netflix and others.

Likewise, Windows 10 has features built into it that integrate tightly with Xbox usage. And the Anniversary Update brings with it improvements for features like higher-frame-rate (60fps) recording of games captured on Windows 10 PCs, enables cross-platform access to

Xbox Play Anywhere (go.pcworld.com/playanywhere) games, and adds game hubs for PC games.

On the Xbox One and One S, Cortana makes her official debut. (As does voice commands over a headset.) In many ways, Cortana just replaces the familiar “Xbox, [do this]” commands, such as snapping a live TV window alongside a game. She’s also a bit slow to respond in certain situations, but Microsoft’s hardware, properly configured, can pick out your commands from a fairly noisy environment. For original Xbox One owners who were frustrated by Kinect’s lack of consistent responsiveness to voice commands, this Dashboard update may provide some relief.

But these updates also come accompanied by some quirks in performance. In particular, my experience with the game streaming feature (which allows Windows 10 PC users to remotely control and play games from their Xbox One) was far less successful on the One S than my original console.

Even though I reproduced my earlier setup—the Xbox One S was down a floor, and several rooms away—performance was inconsistent.





On one night, I was able to connect a Windows 10 Anniversary Update PC to the One S, and play *Forza Motorsport 6* and *Forza Horizon 2* at Medium detail levels, with just occasional disconnects. A day later, and the PC couldn't find the One S at all.

Granted, I've had better luck playing games like the slower-paced *The Witcher 3* over streaming, which probably places less stress on the connection. So much of the experience when streaming games depends on the game, the network quality and bandwidth, and other factors. But for me, the experience wasn't quite as good.

I will say, however, that the wireless connection between the controller and the Xbox One S is excellent. While the One S controller can connect wirelessly to your PC via Bluetooth (click the pair button on the controller to initiate it), you may find, as I did, that it will first successfully connect to the console. That may have played a role in my streaming issues, since I had better luck connecting a wired Xbox 360 controller to my PC and playing that way.

Yes, the One S plays games just fine

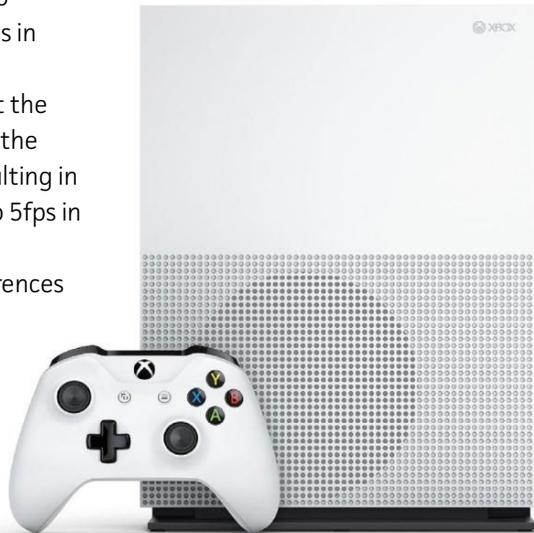
We haven't forgot that the Xbox One is a game console. Perhaps you like to play the occasional console game (*Halo*, after all, has yet to come to PC)—maybe you like to play more often than that. If so, you'll be happy to know that the One S is virtually the same gaming experience as the Xbox One.

There are some minor differences, due to improved hardware. The launch edition of the Xbox One S has a massive 2TB hard drive, which allows games to be stored locally and launch quickly. (That said, the cheap USB external drive attached to my original Xbox One does provide the equivalent amount of storage with acceptable performance.) Games that take advantage of the One S's HDR capabilities are also on their way, like *Gears of War 4* and *Forza Horizon 3*—though it'll take months before they arrive.

And the One S is supposed to upscale games if you're playing on a 4K TV, but so far, I haven't seen anything that indicated that is indeed happening. I connected the Xbox One and the One S to different HDMI ports on the same 4K display, then played the same games to try and discern any difference. Of the games I tried, all looked identical between the two systems, and I noticed no differences in frame rate.

(In a report, Eurogamer found that the One S clock is 7 percent faster than the One—914MHz versus 853MHz, resulting in small frame rate increases of 2fps to 5fps in certain games and under specific conditions. Again, I noticed no differences between the two consoles in terms of frame rate.)

"Upscaled experiences will vary based on the game or app," Microsoft said, when I asked whether my experience was out



of the ordinary. So this feature's appeal will depend on how well and pervasively it's supported in the future.

Should you buy this console?

For me, the One S is the equivalent of retooling an American automobile for the European market, shrinking it down while adding the latest gizmos to appeal to a fresh audience.

For PC fans who already happen to own an Xbox One and don't own a 4K TV, I'd say to hold on to your money and wait for Project Scorpio in 18 months. By then, 4K TVs should be even more advanced and potentially cheaper, and in the meanwhile you can still play whatever console exclusives you love on the original Xbox One.

But if you've already invested in 4K hardware, and either want to get your hands on *Halo* or just a much more versatile 4K Blu-ray player, then why not? The One S has taken Microsoft's original concept of an all-in-one entertainment device and improved it nicely for the 4K generation. 📺

For PC fans who already happen to own an Xbox One and don't own a 4K TV, I'd say to hold on to your money and wait for Project Scorpio in 18 months.

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Logitech G933: This wireless headset is so good, you can skip its high-end competition

BY HAYDEN DINGMAN



LOGITECH HAS BEEN pushing hard to win back the gaming crowd in recent years—and I'll be damned if the G933 (go.pcworld.com/logitechg933) isn't one of its best shows yet.

How good? Well, I'd probably save a \$100 (or more) and take this headset over our long-standing high-end recommendation of the Astro A50 (go.pcworld.com/astroa50) and the SteelSeries Siberia 800, barring a few exceptions. Indeed the G933 can currently be found on Amazon (go.pcworld.com/logitechg933amz) for well below its MSRP.

Modern looks

As an update to Logitech's G930, the G933 sports a familiar look. It's got the same bulky air traffic control heft, the same coffin-shaped earcups instead of traditional round ones. It's easily identifiable as the heir to Logitech's old gaming headset.

Nevertheless, the G933's been prettied up.

Logitech has added RGB lighting, of course. Like the rest of the company's modern lineup, the G933 sports full 16.8 million color profiles for the strips of lighting on the rear of each ear and the lit-up logos on the facing sides. Sure, it's pointless. But it looks good, and Logitech continues to offer some of the best lighting in the industry.

But illumination aside, the G933 is simply a sleeker headset. The G930's ears were particularly ugly, a flat slab of matte-finish plastic saddled with the old, very-corporate Logitech logo and some chunky controls.

The G933 ditches that enterprise look, and instead features a less obtrusive logo (and logo placement), as well as some decorative accents that give it a lighter aesthetic. Some of it's strange and a bit overdone—like a scattering of decorative triangle shapes inside the headband—but for the most part, these changes help the G933 look more like a modern headset and less like a relic of the '90s.

The G933 also moves its buttons to the rear of the headset, which helps with its clean, uncluttered look. All controls sit along the back of the left ear, and each has a unique shape for easier memorization if that's your thing. You can control the power via a switch, toggle the EQ setting, turn surround sound on or off, cycle the lighting effect, mute the microphone, and adjust the volume. You can also reprogram the three "G" keys in the middle (labeled G1, G2, and G3) with a ton of

Logitech G933 Wireless

AT A GLANCE

The Logitech G933 would be a pretty good headset at its list price of \$200. At its pretty-much-permanent sale price of \$150 to \$180, it's probably the best price-to-performance ratio you can get for a wireless headset right now.

PROS

- Rear buttons are intuitive and useful
- Boom mic is invisible when stored
- Capable sound

CONS

- Microphone picks up every background noise
- Fits a bit tight
- Battery life is good, but still shorter than the competition's

\$200





other preset commands—or entire macros.

Also on the left ear is the microphone, though you might miss it at first glance. It retracts and folds directly into the earcup, making it practically invisible—but then folds down like a normal boom microphone and extends out so you can bend it toward your mouth.

The design is a gorgeous bit of engineering, albeit pretty useless. With headsets that I can use as decent street headphones, like the Polk Striker Pro (go.pcworld.com/polkstrikerpro), having a detachable or foldable microphone is useful. The G933 is so bulky, though, that I doubt I'd wear it away from my computer. The microphone style speaks to Logitech's ingenuity more than practical application.

A more useful design aspect is convenient storage of the USB dongle, given that I've misplaced wireless dongles in the past. You just pop off the plastic plate on the left ear cup. The right plate also pops off, in case you want to replace the G933's battery in the future.

Rounding out the design, the bottom of the left ear has a micro USB charging port and a 3.5mm analog jack. You can use the latter to plug the G933 into a phone, gamepad, or whatever—no battery required, though you'll lose out on the lighting. But again, I wouldn't wear these on the street. They're big and goofy, despite Logitech's improvements.

My one and only problem with the G933, and a reason for some of

you to stay away: It's tight. The fit gets better the longer I wear it, but this headset still tends to vice-grip my head and leave me sore after a few hours of use. Corsair's Void Wireless slips around more, but feels more comfortable—as does the Astro A50, if you're willing to stomach the jump in price.

Bone rattlers

The G933 certainly sounds good, though. Running the default Flat stereo setting, it's a moderately bright, punchy headset. I could do with a bit more low-end—and I did adjust that immediately by utilizing the Drop The Bass (eye-roll) EQ setting, and then tweaking from there.

But the G933 is a solid setup. The oversize ear cups give audio plenty of room to breathe in both gaming and non-gaming environments. Music sounds surprisingly good, too, though I'd still give the edge to the Astro A50 or HyperX Cloud (go.pcworld.com/hyperxcloudrev) (or any number of actual headphones).





Like most headset manufacturers these days, Logitech touts G933's 7.1 capabilities. I'll give them this: The G933 has better simulated surround sound than most. Unlike some notable competitors (I'm looking at you, Corsair), enabling surround doesn't ruin the G933's sound. There's little noticeable distortion, and in some games (*Battlefield*, for instance), it even does a serviceable job emulating surround.

But those moments are few and far between, and even a "pretty good" implementation of surround sound in a headset doesn't really measure up to even the weakest of real-world, multi-speaker setups. I ended up leaving the setting off most of the time, because it either added very little or actively detracted from what I was listening to: for instance, muddling sounds together and creating a jumble of noises or hollowing out the center channel. The G933 in stereo is good enough as is.

The G933's microphone's frequency response is decent, but this mic is more sensitive than most at picking up background noise. Every creak of my chair registered loud and clear, and my voice had a noticeable amount of hiss behind it—possibly from the microphone picking up the sound of my computer's fans. So it'll work, but maybe

consider using push-to-talk so you don't annoy your teammates.

As for range, I was able to get the usual 10 meters away from the dongle before audio dropped, even in my high-interference apartment. I did, however, notice that after the sound cut out and I moved back toward my PC, it took longer for the G933 to find a signal than it took other headsets.

Battery life is a bit disappointing—if only because I just experienced that of the Corsair Void Wireless and Razer Man O' War (go.pcworld.com/razermanowarrev). My usage averaged around eight hours before needing a recharge. While this is better than most wireless headsets, it pales in comparison to the 12-plus hours you'll get with the Man O' War and Void Wireless.

Two final side notes: Logitech has fixed some early issues with the G933, so feel safe to ignore these points if you hear about them. First, you can now change how long the G933 idles before turning off. And second, the headset no longer thinks "50 percent battery" constitutes "Low," and thus won't commence beeping at you every two minutes for four hours. Those were my biggest complaints, and they've been resolved by a firmware update.

Two final side notes: Logitech has fixed some early issues with the G933, so feel safe to ignore these points if you hear about them.

Bottom line

The Logitech G933 would be a pretty good headset at its list price of \$200. At its pretty-much-permanent sale price of \$150 to \$180, it's probably the best price-to-performance ratio you'll find, as wireless headsets go.

Sure, the Astro A50, SteelSeries Siberia 800, and the rest of the very high-end wireless headsets nail a few particulars better than Logitech—but they're also twice as expensive. The G933 is good enough that most users won't even notice a difference, and it's priced reasonably for a wireless headset. You can burn the money you'll save on a Steam Sale. 

Corsair Void Wireless: This headset is your best bet if you must go wireless

BY HAYDEN DINGMAN

ONCE UPON A time, a wireless gaming headset would cost you \$300. That's quite a premium, considering you can find a quality wired headset for under \$100.

But over the last few years, the push for affordable wireless headsets has grown. Corsair in particular has spearheaded the push for cheaper



wireless, and the Void Wireless (corsair.com/void) is its latest iteration. The price is phenomenal—only \$100 on Amazon (go.pcworld.com/corsairvoidamz) (and sometimes even less)—but it's so low that it's hard not to be suspicious. Can you really get a quality wireless headset for that cheap?

An unconventional approach

The answer is “sort of.” It's important to point out that I think the Void Wireless is a solid improvement on Corsair's previous wireless model, the H2100—and not just because Corsair ditched the tribal tattoo logo and went back to the traditional trio of sails.

It's a markedly better design. Weird, for sure—the earcups are kite-shaped rather than round, which looks odd. But the Void Wireless feels solid, with metal hinges and a padded metal headband that sits slightly forward on the head. I wasn't a huge fan at first, but it helps offset the weight of the set.

Yes, the Void Wireless is heavy. Not just heavier than your average wired set, but heavier-feeling than its wireless competitors, too. And while the forward-slanted band alleviates the problem a bit, it still has a tendency to slip around if you look down.

That being said, it's comfortable enough for long gaming sessions. The ears are a bit on the small side, and you should expect to play around with the headband adjustments until you get the earcups situated perfectly, but once you do there should be little to no tension on your jaw. The band controls most of the fit.

And despite the fact Corsair sent us the bright-yellow version of the Void Wireless to review (complete with yellow-accented USB dongle), it seems like the default is now the black model. A relief, particularly because the Void Wireless comes with

Corsair Void Wireless

AT A GLANCE

At just under \$100, Corsair's Void Wireless is mostly a good wireless headset, but you will encounter some compromises.

PROS

- Incredible price for a wireless headset
- Top-notch battery life
- Long live the Sails logo

CONS

- Feels heavy, slips around
- Plosive-prone microphone
- Not as soundproof as overear competitors

\$100



RGB lighting, and it turns out that not much goes with “Stab Me In The Eyes Yellow.” The lighting is understated here though—just the sails logo and a small accent line on each cup. It’s a nice nod to the RGB capabilities of other Corsair peripherals without being overly showy or distracting.

Battery life is top-notch for a wireless headset, hitting 12 hours reliably with all the RGB lighting on and turned up. You should get 15 hours easily if you go dark. Point is, it’s enough to get you through a long day or two of gaming. And if you need to, you can charge it as you use the set.

The microphone is your standard boom design. You can flip it out of the way when idle but it doesn’t detach. This is a gaming headset first, not a pair of headphones pulling double-duty.

Corsair touts a feature called InfoMic which is actually just some LEDs embedded into the mic boom. It’s meant to convey a range of





information—not just mute but EQ, Dolby status, and battery life. In practice, however, I found the LEDs too small and out of the way for them to be at all informative.

Finally, the Void Wireless comes festooned (like any half-decent wireless headset) with a handful of controls built into it. On the outside face of the left ear are the mute and power buttons, while a volume rocker sits on the rear. The rocker also pulls double-duty as a button to cycle through EQ settings, but it's a bit like trying to push down on a Jell-O mold—it has a tendency to rock back and forth instead of pressing neatly inward.

Solid untethered sound

The real test for Corsair is audio quality, though—especially in light of the ultra-bright, ear-fatiguing sound of the H2100s.

The Void Wireless sounds pretty good. Yes, you can get better audio for cheaper if you go wired—like, say, the always-popular HyperX Cloud (go.pcworld.com/hyperxcloudrev), or any number of headphones if you don't need a microphone. And yes, you can get better audio quality from a different wireless headset if you spend more money.

But for under \$100? The Void Wireless is a huge improvement on its



predecessor and good enough that I feel comfortable recommending it for everyday gaming usage.

It's still a bright headset on account of the bass being a bit underpowered. The midrange is clear and punchy though, and the highs have been rolled off enough that you don't get the sharp sound of the H2100. Audio does have a weird, overly compressed slickness, but it's only really noticeable if you compare the Void Wireless to a better set of headphones.

Things get even better if you're willing to download Corsair's CUE software and fiddle with the equalizer for a while. While the Void Wireless will never be a bass powerhouse, you can get it to sound pretty decent by pushing the low end up a bit and maybe bumping a few of the highs if you want guns and the like to sound extra crisp.

Again, it's not going to win an award for sound—but for under \$100? Wireless? Yeah, it's pretty damned good.

The microphone is probably the biggest letdown. Which, if you read a lot of headset reviews, is not too surprising. Corsair's problem is twofold. First, the range is pretty narrow and it sounds like you're talking through a cell-phone mic. Second, it has a bad habit of picking

up any and all plosives.

Another notable issue: sound leakage, both incoming and outgoing. Even though this is an over-ear headset, the Void Wireless doesn't seal well at all. As a

user, it's hard to hear in noisy environments. In quiet ones, other people can clearly hear sound coming from the set, even at low volumes—not good if you don't want to annoy your roommates.

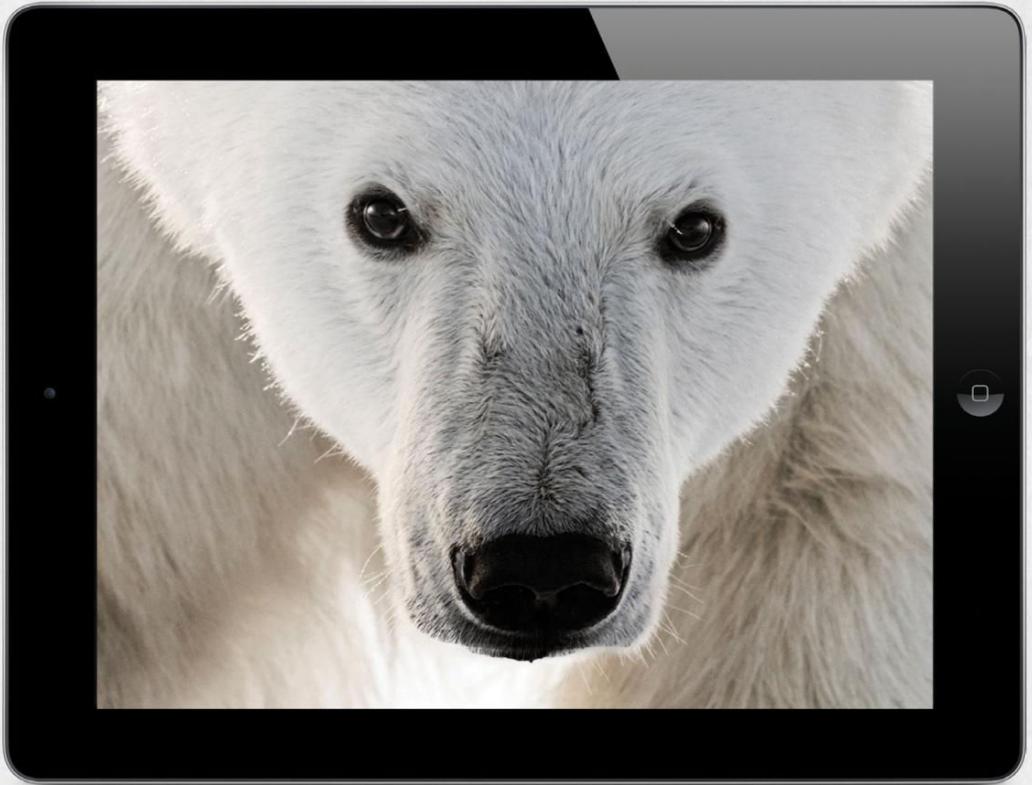
And don't get me started on the Void Wireless's faux-surround. It's awful, just like it was on the H2100. If anything, audio actually sounds less three-dimensional with the software-driven 7.1 turned on. Leave the Void Wireless on stereo at all times. You'll be much happier.

Leave the Void Wireless on stereo at all times. You'll be much happier.

Bottom line

If you don't absolutely need to go wireless, I'd still recommend saving a few bucks and getting a better headset—the aforementioned HyperX Cloud is still our top recommendation.

But for wireless on a budget, Corsair's Void Wireless is your best bet. It's affordable, and it gets the job done. You could ask for a few more things, but we'll leave that to Corsair's next iteration. It's not like anyone's giving them real competition in this price range. 



THE CLOSER WE GET, THE MORE WE SEE

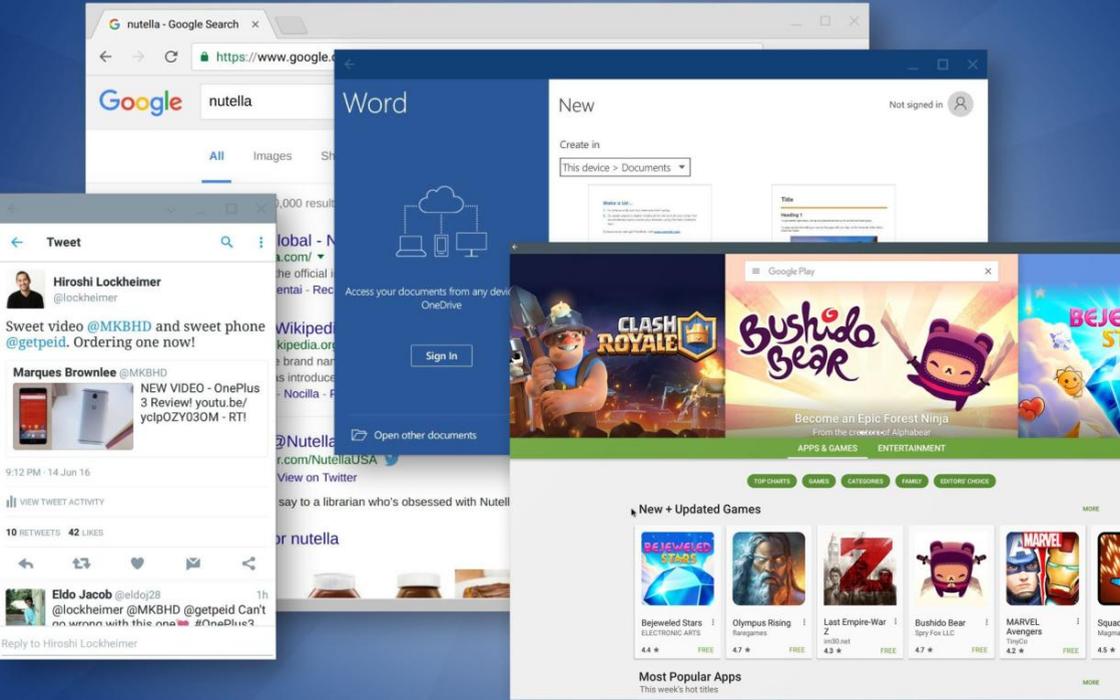


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For Chrome OS to really be the new Windows, it's going to need some apps that perform like they belong on the desktop.



7 ANDROID APPS THAT COULD TRANSFORM CHROMEBOOKS

BY DEREK WALTER

PUTTING CHROMEBOOKS TO WORK

The Google Play Store is coming to a Chromebook near you. But for this to really make a major difference in how we use Chrome OS, it's going to take the right apps.

And they need to do more than just look and perform like blown-up phone apps. Shoot, you can have that on an Android tablet. Instead, for Chrome OS to be a game changer, it will need Android apps that are repurposed to offer more than their web counterparts.

Time's running out for developers, because the Google Play Store is already rolling out to the Asus Chromebook Flip in the developer channel version of Chrome 53. After a stopover on the Chromebook Pixel (2015 model only) and Acer Chromebook R11/C738T, Google will start to make the Play Store available on several other Chromebooks (go.pcworld.com/chromeosandroid) later this year.

But if Android app developers do it right, then it won't be long before your Chromebook is a substantially more powerful computer than it is right now. Allow us to summon a genie from our magic lamp (a bit of hard-core hardware Executive Editor Gordon Mah Ung would be proud of) to make some wishes for the Android apps we want to see.



MICROSOFT OFFICE

During the demo at Google I/O, presenters showed off Microsoft Word to illustrate how a Chromebook could be just like a traditional PC. In

fact, I couldn't help but think during the event that Google had just invented...Windows.

While you'd think this would be very bad for Microsoft, that may not be the case. Microsoft is all about selling those Office 365 licenses, and if Word, Excel, PowerPoint, Outlook, and OneNote perform well, then Chrome could be a great platform on which Microsoft can peddle its wares. How times have changed.

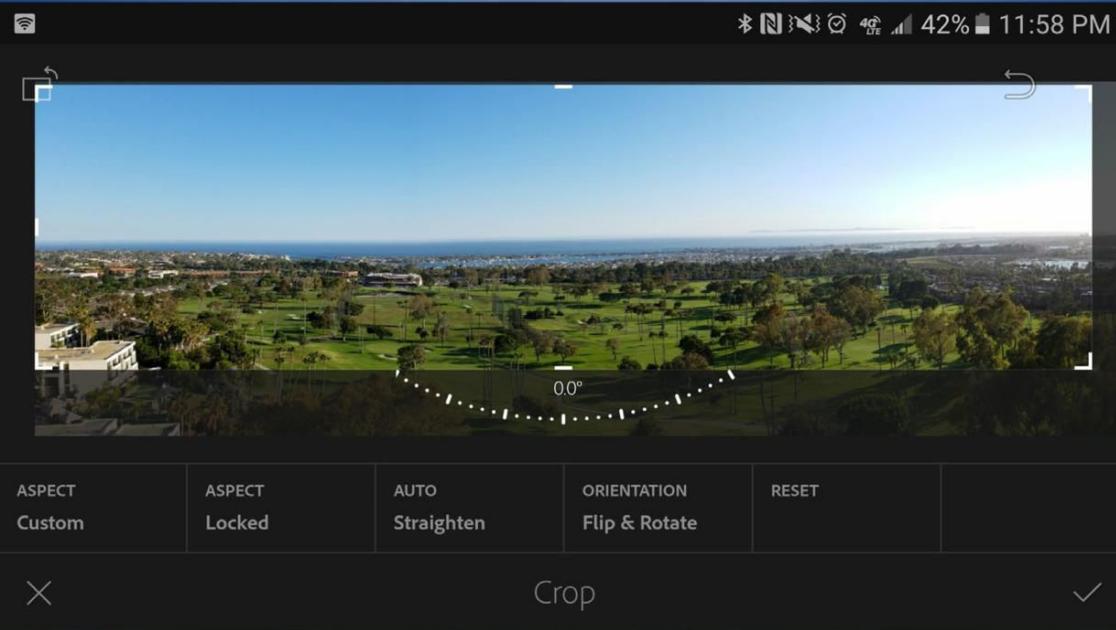
A Microsoft spokesperson told *PCWorld*, "With the Google Play Store coming to Chromebooks, Office 365 subscribers will be able to use Office apps like Word, Excel, PowerPoint, and others to be productive wherever they go with their Chromebooks or tablets. Our joint customers will enjoy the flexibility, power, and familiarity of Office with a look and feel they're used to on their Google devices."

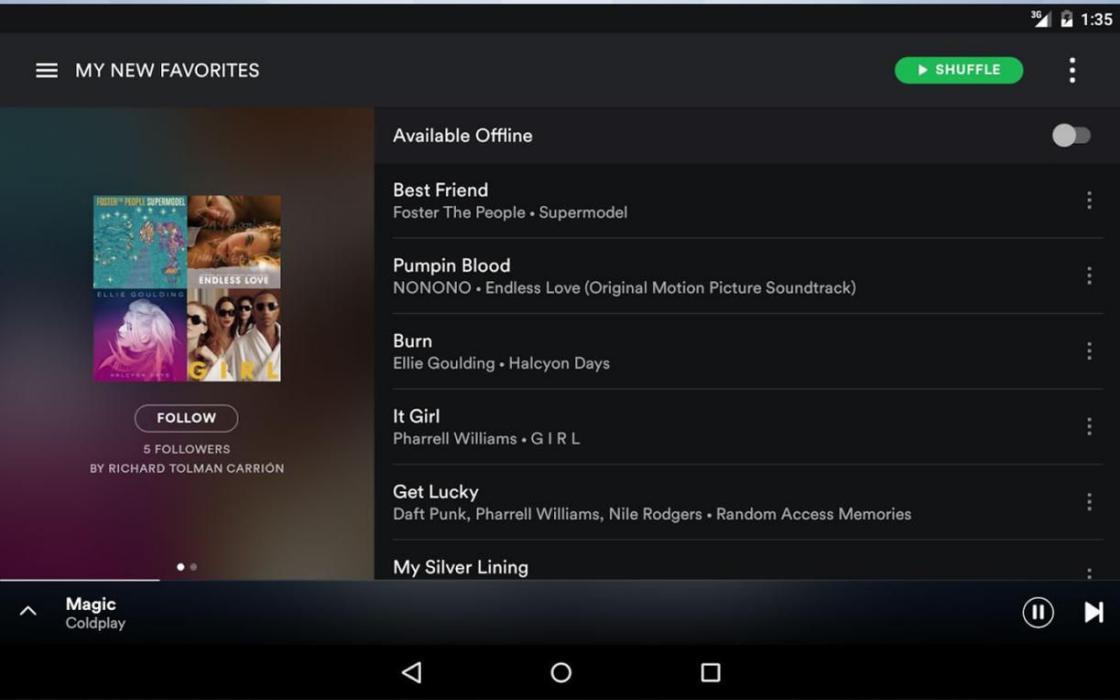
ADOBE LIGHTROOM

Yes, you can do photo editing on a Chromebook (go.pcworld.com/cbeditimages). But that doesn't mean it's always easy, especially

if you end up somewhere with limited Internet access. Lightroom, and by extension similar photo-editing apps, would go a long way toward bridging the gap between Chromebooks and more traditional PCs.

Adobe's tools on Android are already pretty strong, and there's possibly more that could be done with a larger platform to address. If even moderate-level photo editing can be performed on a Chromebook, that bodes well for anyone thinking about making one their full-time computer.





SPOTIFY

It doesn't have to be all work and no play. When it comes to streaming music,

Spotify is the current champ, though that web interface could definitely use some work. Using the Android app could turn out to be the right solution, particularly if you're able to tap in to offline storage and use many of the app-specific features on Chrome OS.

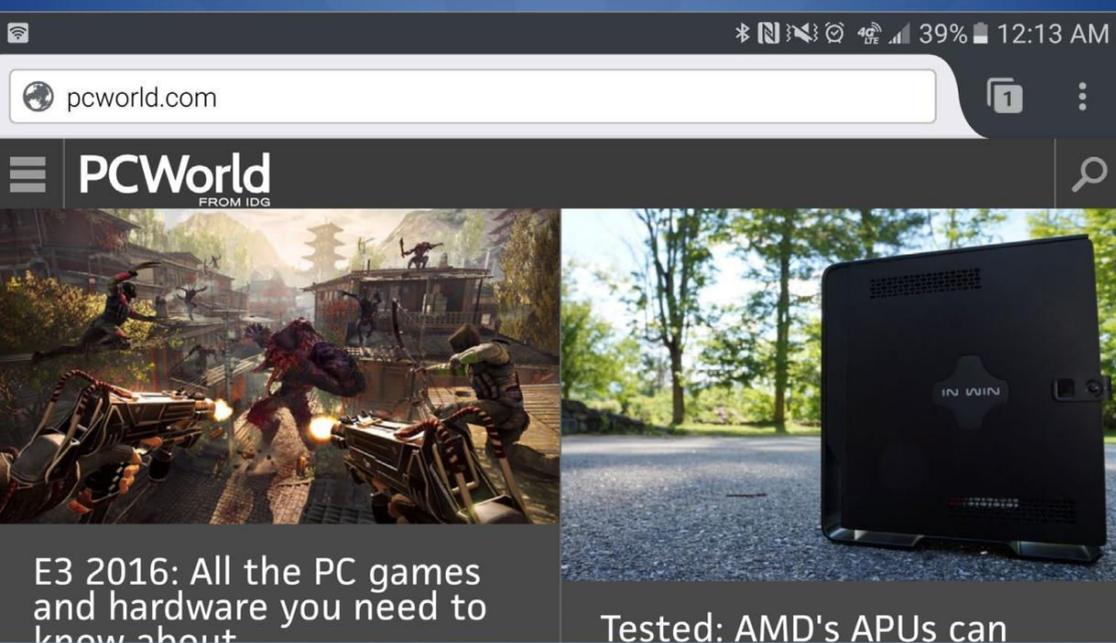
The Android app is far superior to the web experience, so if there are some tweaks to the interface to make it scale well on a larger screen, Spotify could rule our hearts and tunes when working away on Chrome OS.

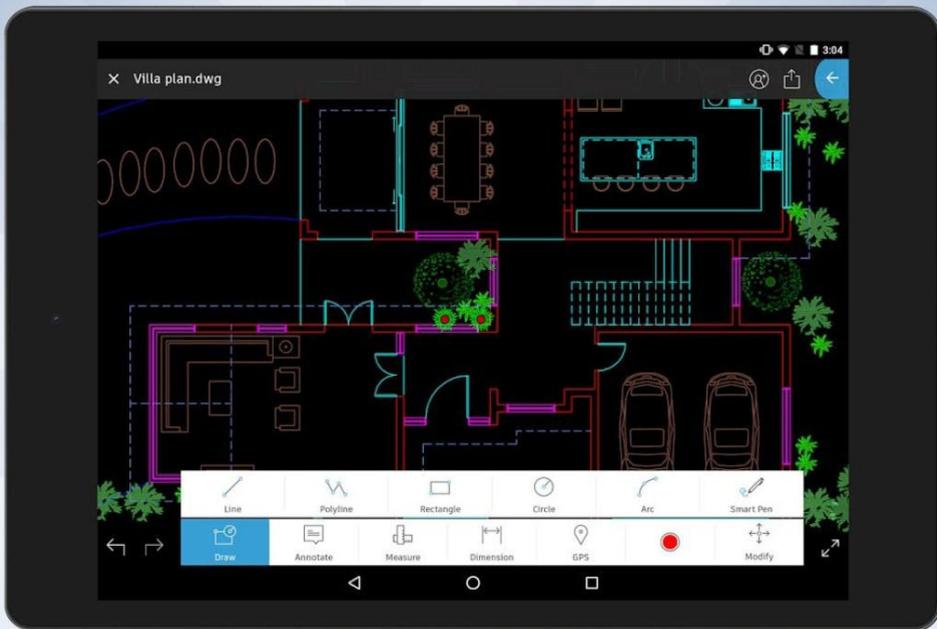
THIRD-PARTY BROWSERS

It may seem to violate all that is

holy and true, but according to those who've tried it out,

Firefox and other browsers work just fine on a Chromebook. If so, this would surely make Chromebooks more like full-blown PCs, which have no allegiance to any one browser. Whether you like variety, or need access to different browsers as a developer or for some other function of your job, this openness could make a huge difference for Chrome OS. It also can't hurt Google's efforts to stave off further antitrust investigations.





AUTOCAD

Facilitating advanced design work, as with AutoCAD (go.pcworld.com/playautocad) and

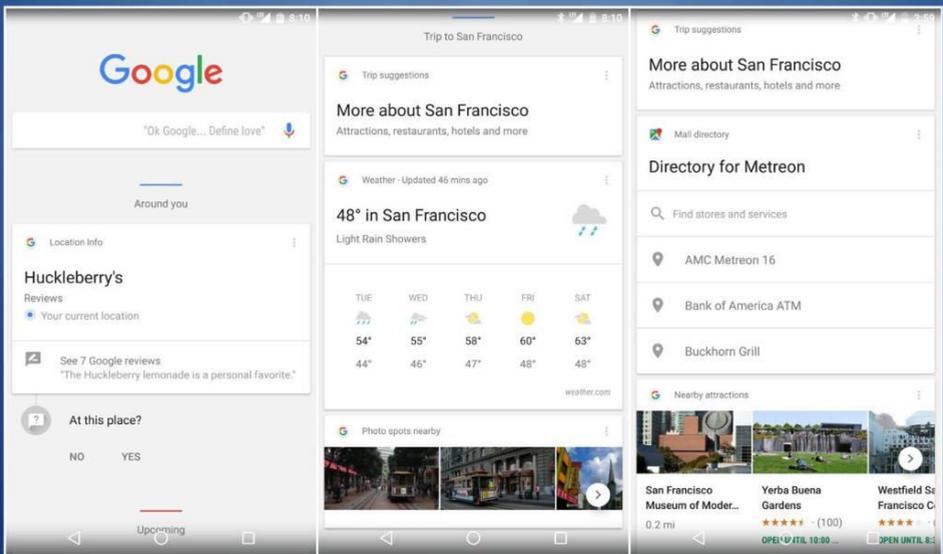
similar tools, was never part of Chrome OS's charge. But now it's a very real possibility if the Android app can be brought up to snuff. It's an especially intriguing possibility on touchscreen-equipped Chromebooks, from the uber-expensive Pixel to the impulse-buy-level Chromebook Flip.

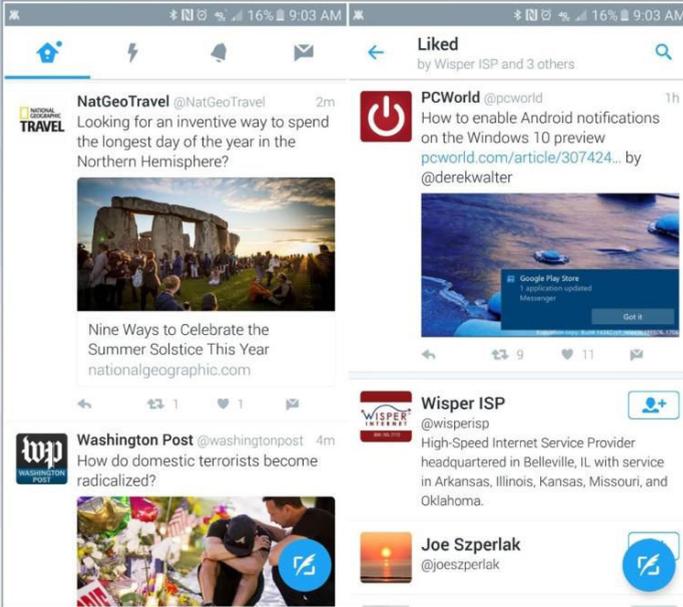
Pen input right now is currently ruled by Microsoft's Surface line and other touch-friendly Windows laptops. But Chromebooks could make a play for those who want to design tools that are friendlier to touch.

GOOGLE NOW

I've often felt that Google Now (go.pcworld.com/googlenow tips) is rather underserved on my Chromebook. Considering you're on a Google operating system, there ought to be deeper integration than the few cards that pop up when you hit the search button.

A dedicated Google app could fix this, giving you all those instant sports scores, contextual updates, and other details to get you through your day. Google's superior contextual awareness is one of the things that drives people to Android, and it would be a great advantage if put to full use on Chromebooks.





TWITTER

Love it or hate it, you can't really ignore the Twitter.

At least managing the

rapid-fire social network will be a lot easier with a dedicated Twitter app. On a Chromebook you're stuck with the Twitter website or the oft-neglected TweetDeck. With a dedicated Twitter app, you'll be able to get notifications, direct messages, and all the other brief missives that should keep you sufficiently unproductive. In a recent tweet, Android and Chrome head Hiroshi Lockheimer hinted at this very capability, along with a tease of what Andoid N will be called.



For more safety tips visit SmokeyBear.com

ONLY **YOU** CAN PREVENT WILDFIRES.



There I was, a first-time PC builder sitting in my office with all the components I'd ordered: a CPU here, a PSU there, plus my trusty anti-static wristband and a screwdriver. I had everything I needed to build my first PC. But I was afraid to open that first box.

Why was I paralyzed? Lots of reasons. With no single manual to cover all my PC parts, where was I supposed to begin? What if I couldn't cram all those cables into my PC case? Had I already blown it by not getting an optical drive? Worst of all, what if I put everything together and my PC refuses to turn on? *PCWorld's* comprehensive build guide (go.pcworld.com/diypc) covers all the steps, but in the heat of the moment, details specific to my situation and other random concerns kept popping up.

In retrospect, I wish I'd worried a little less about my first build and enjoyed it a bit more. After all (and as I ruefully discovered later) there's only one first time when it comes to putting together your own computer.

Let my minor traumas be your teachable moments. Read on for seven things I wished I'd known before building my first PC, starting with...

1. YOU CAN TRANSFER YOUR CHOOSEMYPC BUILD TO PCPARTPICKER WITH ONE CLICK

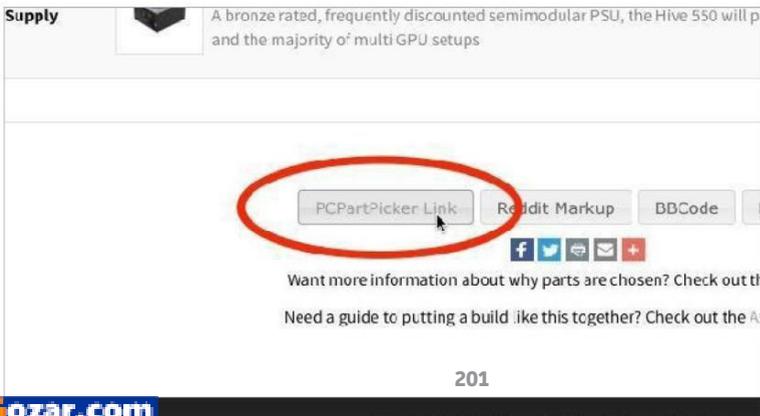
This first tip is more about the planning stage rather than the build itself, but it's still something I wish I'd known before wasting a precious hour or two.

For those of you who haven't heard of it, [ChooseMyPC.net](#) is a great first stop for building your PC. Just pick a price point by adjusting a slider, make a few quick choices (such as whether you're planning on "overclocking" your PC and whether you need a copy of Windows), and ChooseMyPC will generate a parts list for you.

Of course, the parts list that ChooseMyPC creates will by no means be definitive—part of the fun of building your own PC is picking and choosing your own components. That said, an initial, auto-generated ChooseMyPC build makes for a helpful starting point.

Once you're ready to customize, you'll want to move your parts list over to [PCPartPicker.com](#), an invaluable site for organizing and tinkering with your PC part lists (and believe me, you're going to end up with multiple lists for your first build).

Handy though it is, PCPartPicker didn't make it easy when it came to re-creating my ChooseMyPC build. Searching for a particular component often came up with multiple hits, and I was puzzled that even the most generic searches (like "Intel Core i3") came up empty.



I wish I'd seen this button before I spent hours transferring my ChooseMyPC build to PCPartPicker by hand.

(The reason: PCPartPicker's "compatibility filter" screens out parts that won't work with your current build.)

Little did I know that I could have saved lots of time and frustration with a single click. (Cue the forehead slap.)

Once you've created your ChooseMyPC build, look for the PCPartPicker Link button at the bottom of the parts list and click it. The entire build will automatically be transferred to PCPartPicker, no searching required.

2. SIZE MATTERS WHEN IT COMES TO THE CASE

It's easy to get distracted by bright, shiny things when it comes to picking a PC case, and I mean that quite literally.

In your research, you'll find plenty of cases with flashy, neon-lit windows, perfect for showing off the innards of your custom-built PC. Cool though those side windows are, though, another feature meant much more to me: space, and lots of it.

Why the need for space? One of your main tasks when it comes to building your PC is dealing with all the cables connecting your various components. Not only do you want to make sure all your cables go where they need to go, you also need to make sure they're tucked inside in a fashion that allows for plenty of unobstructed airflow.

There's nothing wrong with choosing a jumbo case if you're a first-time PC builder.



Proper cable management will keep the inside of your PC neat, tidy, and cool. Sloppy cables, on the other hand, could leave you with a melted CPU.

Expert PC builders pride themselves in picking just the right case for their particular build—not too big, not too small. Indeed, perfectly weaving all those cables into a cramped PC case can be akin to building a ship in a bottle.

As a novice PC builder, though, I wasn't shooting for a work of art. I just wanted to get through it—and for me, that meant having plenty of room to work. I wanted to go big.

Generally speaking, PC cases come in three sizes: ATX (the biggest), ATX Mini (smaller), and ATX Micro (even smaller), with variations within each category for “full tower,” “mid tower,” “mini tower,” and so on. In my case, I went ahead and sprang for an ATX Full Tower case.

Now, did I really need a case that big? Of course not. After all, the motherboard I eventually picked was a smaller ATX Mini form factor, I was only installing a single video card, and I wasn't even dealing with any bulky after-market CPU coolers.

During the actual build, though, I loved all the extra room. I never felt cramped, and I had plenty of space for bundling my cables just as I wanted. I also have lots of room to grow.

Bonus tip: If at all possible, consider springing for a slightly pricier PC case (and by pricier, I mean \$60-ish instead of \$40-ish) with beginner-friendly features like “tool-less” drive bays.

Expert PC builders pride themselves in picking just the right case for their particular build—not too big, not too small.

3. NO, YOU DON'T NEED AN OPTICAL DRIVE

One of the first questions you'll be asked at ChooseMyPC.net is whether you want an optical drive to be part of your build. My initial answer: Well, yes! After all, how would I install Windows without a Windows DVD?

Of course—and as I should have known, giving that I can't remember the last time I touched a PC DVD drive—it's easy to install Windows on

a PC without an optical drive.

Plenty of online guides are available, but here's the short version: Just use Microsoft's free "media creation" tool (go.pcworld.com/w10mediacreation) to install a copy of Windows onto a (3GB or larger) USB memory stick. The first time you boot your new PC (and yes, you'll get there), you'll land on the BIOS screen. From there, navigate to your system boot options, then set your PC to boot from the USB stick. Once you boot from the USB drive, the Windows installation wizard will take care of the rest.

Beyond Windows, practically any program or game you'd ever want to install is available for download, no DVD required.

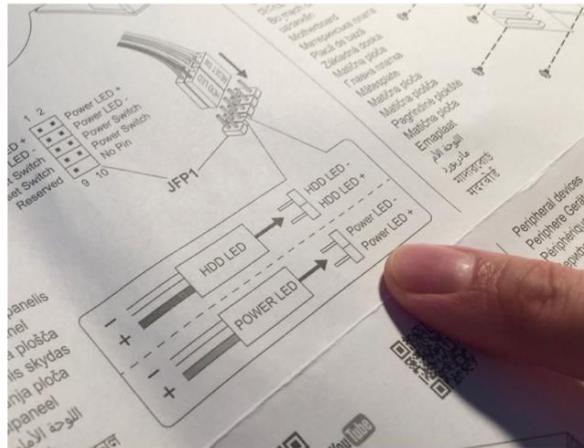
But what if you find yourself in the (unlikely) situation where you absolutely, positively need an optical drive? If that happens, you can always go back, crack open your custom PC and install one, or just grab an external USB optical drive (for all of \$15 or so).

Don't be afraid of the motherboard manual. It looks complicated, but it's an invaluable guide for first-time PC builders.

4. THE MOTHERBOARD MANUAL IS YOUR BEST FRIEND

One of the most daunting things about building my own PC was the fact that there wasn't a single, IKEA-like manual that covered the whole process. Mind you, there are plenty of generic walkthroughs for building a PC (including *PCWorld's* go.pcworld.com/diypc), but nothing telling me how to assemble my own specific components. Instead, there was a manual for each individual component, and many of the directions were sketchy at best.

My reaction was to blunder into the build practically blind, installing the drives first because that seemed like the easiest thing to do.



(Note: While the experts will tell you to install the motherboard first, getting those drives installed was not only easy, but also a big confidence-booster.) Then I seated the CPU in the motherboard (with a sickening crunch as I pushed down on the delicate lever).

Soon enough, I was staring at my PSU, my GPU, my memory sticks and a tangle of cords in my PC case, without a clue about what to do next.

Eventually, my gaze drifted to the motherboard manual, and I began to page through it. Initially, few of the diagrams made sense, but the closer I looked, the more I recognized. Those thin little front-panel connectors dangling in the case? They go right here, the manual said (or at least, that's how I deciphered the diagrams and connector labels.) Expansion ports? Here and here. Memory slots? One here, and one here. Your power cables go here and here, and right here is where your SATA connectors for the drives go.

The more I studied, the more I realized (belatedly, I guess) that the motherboard manual was the key to this whole puzzle. After all, all roads lead to the motherboard (or the “mobo,” if you want to sound cool about it) as far as your PC build is concerned, and once you understand where all the various cards, cables, and connectors go on the mobo, you've pretty much nailed your build.

The more I studied, the more I realized (belatedly, I guess) that the motherboard manual was the key to this whole puzzle.

5. THERE'S NOTHING SCARY ABOUT A 'MODULAR' OR 'SEMI-MODULAR' POWER SUPPLY

“Keep it simple” was my mantra as I picked the parts for my first PC build. But nothing sounded simple when it came to one of the biggest choices about picking a power supply—specifically, whether I should go with a modular, semi-modular, or non-modular PSU.

For those of you new to PC power supplies (as I was until just a few weeks ago), the whole modular vs. non-modular issue centers around the cables that connect the power supply to your various PC



components. A modular PSU's cables are all detachable, meaning you can connect just the cables you need and avoid a tangle of unused cables in your PC case. A semi-modular PSU has only the essential power cables attached, with the rest of the cables detached until you need them. A non-modular PSU arrives with all its cables already attached, so no need about worrying whether you've got all the power cords you need.

Initially, I was intimidated by the idea of a modular or semi-modular power supply. What if I didn't know which cables I needed, or where they were supposed to plug in? Did "modular" mean one more thing I had to put together? I started leaning toward a non-modular model, reasoning that a PSU with all the cables attached would be easier to handle.

Tempted by the idea of fewer loose cables in my case, I eventually took the leap for a semi-modular PSU, and I'm glad I did. After all my worry, it turned out the optional detached power cables (like those for the case fans and the hard drives) were easy to identify and connect. As with the motherboard, the PSU came with a manual that mapped out which cables go where. Best of all, I used only the power cables I needed, making for easier cable management in the end.

Of course, that's not to say my PSU installation went perfectly. I made a crucial mistake when it came to plugging in a main power cable, which leads to my next point...

A semi-modular power supply unit can keep the inside of your PC from getting stuffed with a jumble of unneeded power cables.

6. DON'T PANIC WHEN YOUR PC DOESN'T TURN ON

So there I was, all systems go—or so I thought. My motherboard was screwed in and wired up, ditto for the hard drives and front-panel controls, my power cables were plugged in and even my monitor was ready. Taking a deep breath, I flipped the main power switch.

At first, good news: The system fans whirred to life, meaning I'd done something right. But the monitor stubbornly displayed a “No Signal” error, and a telltale red light flashed on the motherboard’s “debug” panel. Then, the bad news: It was the CPU error light that was lit, meaning some kind of processor failure.

Uh oh.

The temptation to panic was strong, but I tried to stay cool as I retraced my steps. The motherboard wiring had been complicated, but I'd followed the manual's directions carefully and a second look revealed no missteps. The power supply, though, gave me pause. I'd been a little sketchy on where the main power cables plugged into the motherboard, and I began to suspect my problems lurked there.

The temptation to panic was strong, but I tried to stay cool as I retraced my steps.

And I was right: I'd ignored a four-pin power socket in the motherboard because I couldn't find a matching power supply cable, but a closer look at the PSU's manual revealed the answer: an eight-pin plug that could be snapped apart into a pair of four-pin plugs. I split the plug in two, connected the correct four-pin section into the motherboard, hit the power switch, and—it worked! Never in my life had I been so happy to see a BIOS screen.

7. YOU'RE GOING TO WANT TO BUILD ANOTHER PC

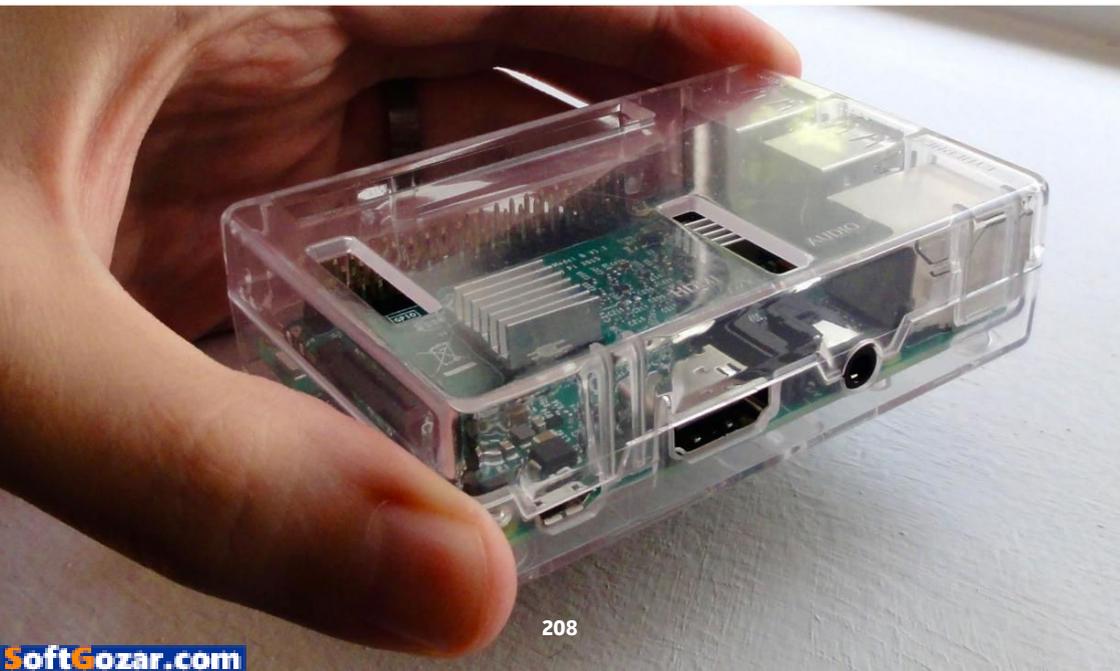
Perhaps my biggest surprise about building a PC was how quickly I'd finish building it—and indeed, I was a bit bummed it was so easy. After spending weeks agonizing over my parts list and painstakingly assem-

bling my components, the actual build took only a few hours over two days. I hoped that installing and configuring Windows 10 would be something of a challenge, but that turned out to be easy, too.

Within another day, I found myself back at PCPartPicker, fiddling around with a new parts list. Yes, I already wanted to build another PC, and if you're a first-time builder, don't be surprised if you wind up with the same urge once you finish.

Note: Instead of coughing up several hundred dollars to build a second PC that I didn't need, I tackled some different DIY projects instead. First, I replaced the optical drive in my aging iMac with a solid-state drive, a \$200-ish project that turned out to be far more difficult than building an entire PC from scratch. (Three trips behind my iMac's 27-inch monitor and a failed SSD later, I finally got it done.) Next, I snagged a \$50 Raspberry Pi, a circuit board the size of a deck of cards that can run Linux and even a pared-down version of Windows 10—just plug in a monitor, a keyboard, a mouse, and an SD card to get started. I'll let you know how that turns out. 

Dying to build another PC right away? A \$50 Raspberry Pi might tide you over.





*“I want
to be
a bench.
Recycle me.”*



IWantToBeRecycled.org

SoftGozar.com



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HERE'S HOW

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Get going fast

Change these at any time (scroll to see more). Select Use Express settings to:

Personalize your speech, typing, and inking input by sending contacts and calendar details, along with other associated input data to Microsoft. Let Microsoft use that info to improve the suggestion and recognition platforms.

Let Windows and apps request your location, including location history, turn on Find My Device, and use your advertising ID to personalize your experiences. Send Microsoft and trusted partners some location data to improve location services.

Help protect you from malicious web content and use page prediction to improve reading, speed up browsing, and make your overall experience better in Windows browsers. Your browsing data will be sent to Microsoft.

Automatically connect to suggested open hotspots and shared networks. Not all networks are secure.

Get updates from and send updates to PCs on the Internet. Send full error and diagnostic

Learn more

Customize settings



Back

Use Ex



Watch the
video at
go.pcworld.com/w10expressvid



Windows 10 upgrade: Don't use Express settings if you value your privacy

Take the time to customize typing, browsing, and other settings from the get-go.

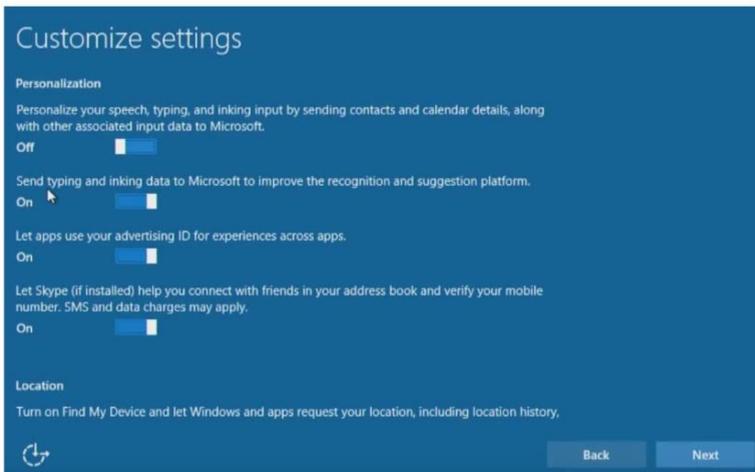
BY JARED NEWMAN

TAKE THE TIME to customize typing, browsing, and other settings from the get-go. When you're setting up a new or existing PC with Windows 10, Microsoft will offer to install the operating system with "Express settings."

Although Windows 10 Express settings will get you up and running quickly, that convenience comes at a cost: By skipping over custom settings, you're agreeing to all kinds of data collection and behavior tracking, much of which didn't apply in earlier versions of Windows.

Here's our advice: Instead of blindly enabling Express settings in Windows 10, take some time to understand what you're agreeing to. Click the Customize Settings link (in tiny text at the bottom of the setup screen), and disable the options you don't want.

Here we'll walk through all of the custom settings in a Windows 10 setup, the benefits and drawbacks of enabling them, and how you can turn them off later.



Customize Settings: Personalization and Location

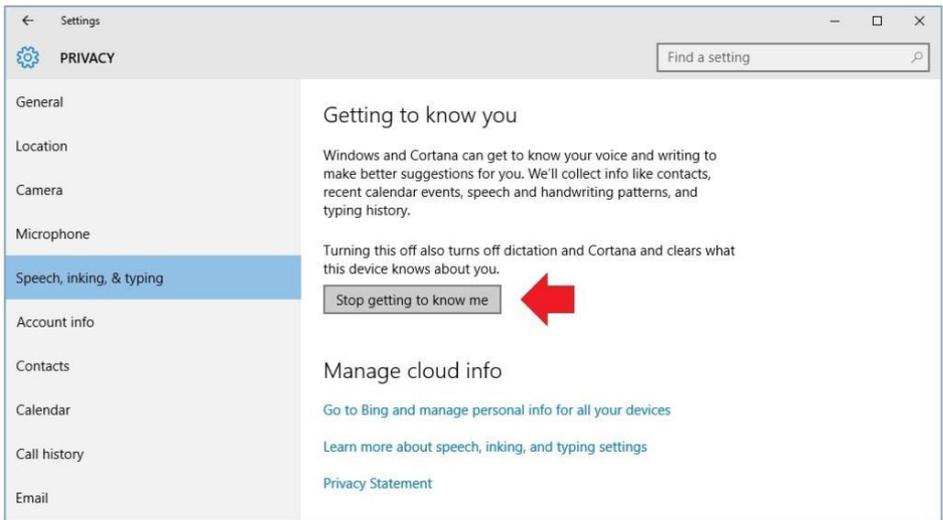
This Windows 10 setup page governs the data Microsoft collects for targeted ads and for certain online services, such as Cortana and Skype. Here are the settings you can control:

Personalize your speech, typing, and inking input by sending contacts and calendar details, along with other associated input data to Microsoft.

Microsoft uses this data for spell-check, auto-complete, and handwriting recognition. For instance, if you have a friend who has an unusual name, Windows 10 can avoid correcting the spelling when you type on a touchscreen or write with a stylus.

This Windows 10 setting is somewhat contentious, with some critics calling it a keylogger (go.pcworld.com/keylogger). However, Microsoft told Lifehacker that it does not collect any personal information from writing or typing. The company chops up text into small bits that can't be put back together, and performs multiple checks to strip away sensitive data such as email addresses and passwords.

You can disable the data collection, of course, but doing so will prevent Cortana from working.

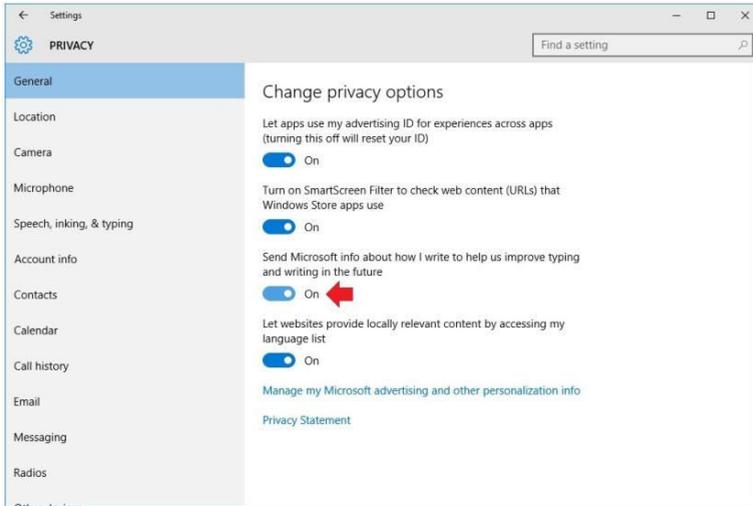


To change this setting after the Windows 10 setup process, head to Settings > Privacy > Speech, Inking, & Typing, and click the button under Getting To Know You.

Send typing and inking data to Microsoft to improve the recognition and suggestion platform.

This setting doesn't provide any immediate benefits, but the aggregate data from lots of users could help Microsoft improve spell-

check and auto-complete in the future. The same privacy contentions from the previous setting apply here, but you're free to disable this setting without losing access to any features.



To change this setting after the Windows 10 setup process, head to *Settings > Privacy > General*, and uncheck the “Send Microsoft info about how I write...” option.

Let apps use your advertising ID for experiences across apps.

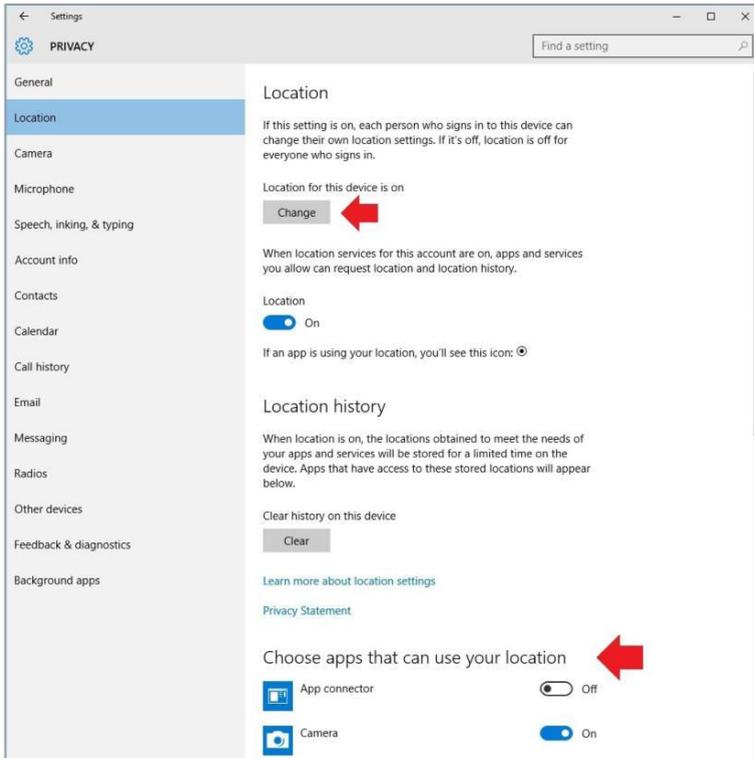
Windows 10 has several types of advertising built in (go.pcworld.com/w10ads), and to personalize those ads, Microsoft generates a unique identifier that tracks your behavior across Windows Store apps. Unchecking this option doesn't remove the identifier, but it does prevent third-party apps from seeing it and showing you targeted ads. (If you don't use any Windows Store apps, this is a moot point.)

To change this setting after the Windows 10 setup process, head to *Settings > Privacy > General* (the same menu pictured above), and uncheck the “Let apps use my advertising ID...” option.

Let Skype (if installed) help you connect with friends in your address book and verify your mobile number. SMS and data charges may apply.

If you have an address book that you've added in Windows (for

instance, through Outlook.com, Exchange, or Google), this setting adds those contacts to Skype for messaging, voice calls, and video chat. PC users needn't worry about verifying a mobile number, as that setting only applies to Windows 10 phones.



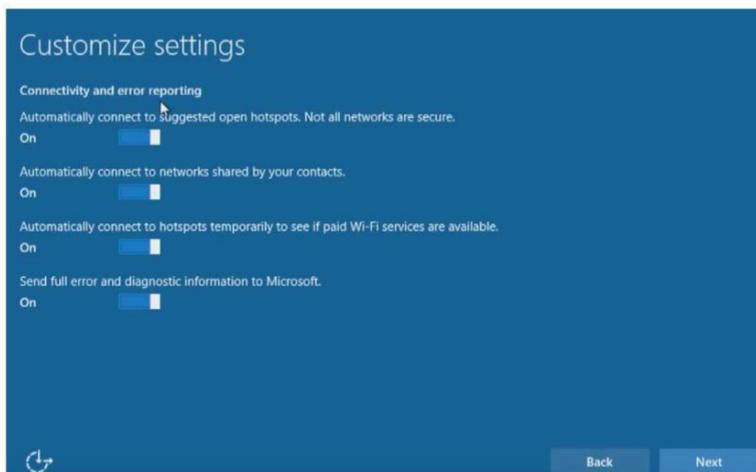
Keep in mind that if you enable this setting, the only way to undo it is to manually remove those contacts from Skype.

Turn on Find My Device and let Windows and apps request your location, including location history, and send Microsoft and trusted partners some location data to improve location services.

Sharing your location allows Microsoft to update your weather information, find you in the Maps app, and provide location services in Cortana. This setting also lets third-party Windows Store apps (such as

Uber and TripAdvisor) access your location, but they'll have to ask for additional permission when you first open their apps.

After Windows 10 setup, you can toggle location services by heading to *Settings > Privacy > Location*. Click the Change button to turn off location for your device, or switch the toggle underneath to disable location for your account only. To disable location for individual apps, scroll down to the Choose Apps That Can Use Your Location section.



Customize settings: Connectivity and error reporting

The second page in Windows 10 setup governs how Microsoft deals with Wi-Fi networks and collects telemetry data. Here are the settings you can control:

Automatically connect to suggested open hotspots. Not all networks are secure.

Microsoft maintains a list of known Wi-Fi hotspots around the world, and with this setting enabled, Windows 10 will automatically connect to them. While this may be convenient in some cases, open hotspots can also be slow and unreliable, and are more susceptible to eavesdropping (go.pcworld.com/unsecurewifi). If you're comfortable connecting to Wi-Fi networks on your own, it's best to disable this setting.

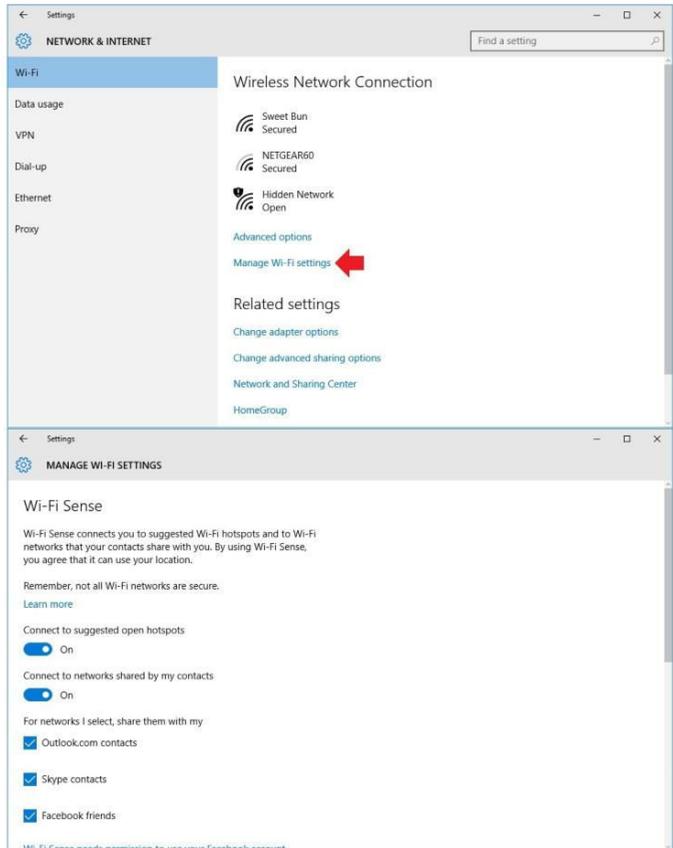
After Windows 10 setup, toggle this feature by going to *Settings > Network & Internet > Wi-Fi*, clicking *Manage Wi-Fi Settings*, and unchecking *Connect To Suggested Open Hotspots*.

Automatically connect to networks shared by your contacts.

This setting lets you connect to any network that's been accessed by your contacts on Facebook, Skype, and Outlook .com—and vice versa—without having to enter a password. It's part of a broader set of features called Wi-Fi

Sense, and it stirred up a controversy due to security concerns (go.pcworld.com/win10wifi). Microsoft may be killing this feature (go.pcworld.com/w10wifisense) in a future Windows update, but for now you'll have to disable it during setup.

To disable this setting after Windows 10 setup, head to *Settings > Network & Internet > Wi-Fi*, and click *Manage Wi-Fi Settings* (the same menu pictured above). Uncheck the *Connect To Networks Shared By My Contacts* option, and uncheck all the boxes under “For networks I select, share them...”



Automatically connect to hotspots temporarily to see if paid Wi-Fi services are available.

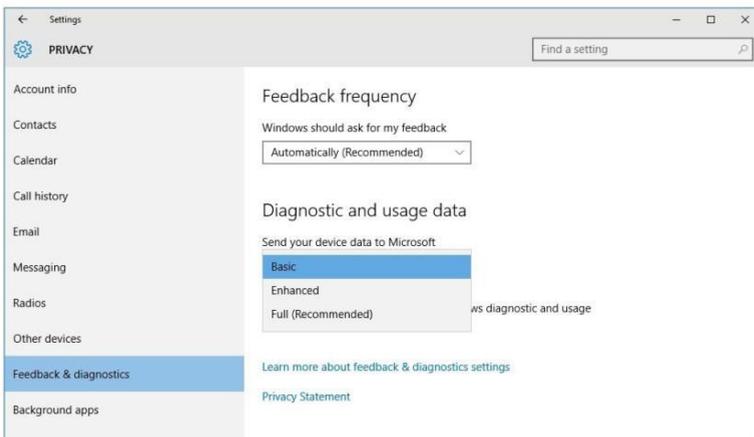
This feature would come in handy if you're at an airport or other public space and are willing to buy premium Wi-Fi access, but don't want to dig through a list of other nearby hotspots to find the paid option. Again, turn this off if you're comfortable connecting to Wi-Fi networks on your own.

To disable this feature after Windows setup, again head to *Settings* > *Network & Internet* > *Wi-Fi*, and click Manage Wi-Fi Settings. Scroll down to Paid Wi-Fi services, and turn off the toggle underneath.

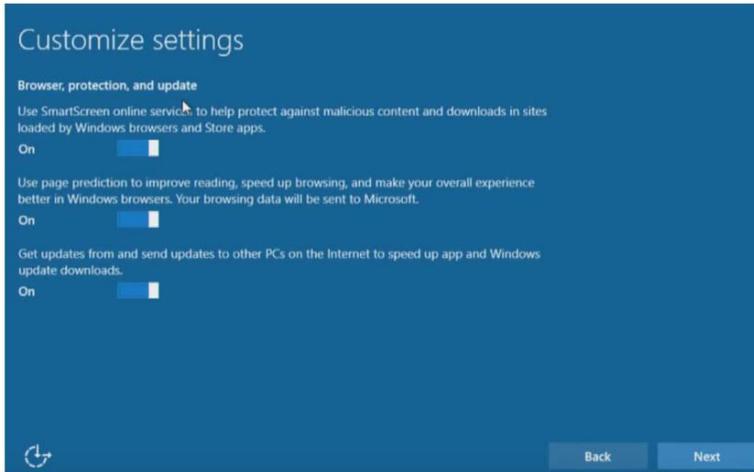
Send full error and diagnostic information to Microsoft

This setting helps Microsoft fix bugs in Windows 10, but there's a trade-off: It allows the company to collect extensive data about your PC, including personal data from your own content. Microsoft says it only collects this data when it needs to diagnose a specific problem, and only from a small sampling of affected PCs. The company also says it won't use this data for identification, contact, or targeted ads. Theoretically, this information should benefit all Windows 10 users, but Microsoft is asking for a lot of trust in return.

You can disable this feature in Windows setup, but Microsoft will still collect data about the third-party software you've installed, and about



how you use certain features and apps. This “Enhanced” level of data collection is largely for diagnostic purposes, but Microsoft says it will also use the data to provide “a more personalized Windows experience.”



There’s no way to stop Microsoft from collecting any diagnostic data, but you can minimize the data collection after setup by going to *Settings > Privacy > Feedback & Diagnostics*. Find the drop-down menu under Send Your Device Data To Microsoft, and select Basic.

Customize settings: Browser, protection, and update

Rejoice: This is the last section you’ll have to deal with before you’re ready to go. It deals with settings in Microsoft’s Edge browser, along with peer-to-peer distribution for Windows updates.

Use SmartScreen online services to help protect against malicious content and downloads in sites loaded by Windows browsers and Store apps.

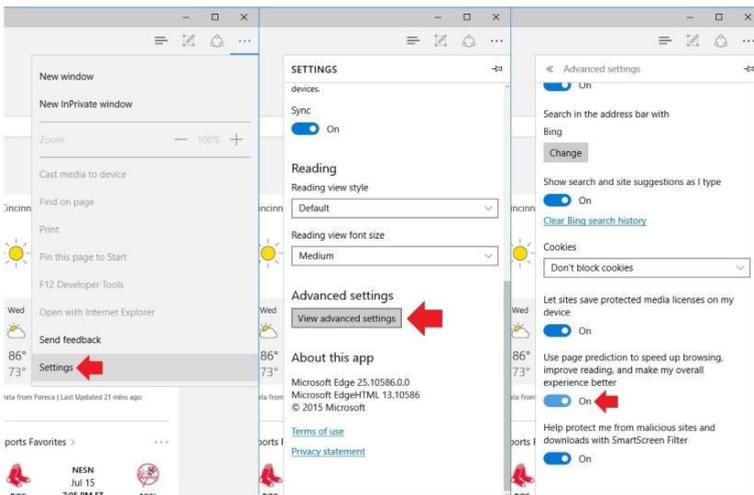
With this security feature enabled, Microsoft downloads a list of malicious websites to your PC, and throws up a warning if you attempt to visit any of them. You could turn this off if you’re not planning to use Edge (a similar feature exists in Google’s Chrome browser), but it’s

probably best to keep this enabled, just to be safe.

If you want to turn SmartScreen off later, head to *Settings > Privacy > General* and uncheck “*Turn on SmartScreen Filter...*”

Use page prediction to improve reading, speed up browsing, and make your overall experience better in Windows browsers. Your browsing data will be sent to Microsoft.

With the Edge browser, Microsoft can guess which pages you’re about to click on, and load them ahead of time so you don’t have to wait. Turning this on will make web browsing feel faster, at the expense of more data collection. (Google Chrome has a similar feature, called prefetch, go.pcworld.com/prefetch.)



To turn off this feature after installing Windows 10, open Microsoft Edge, click the menu button (three horizontal dots) in the top right corner, click *Settings*, then click *View Advanced Settings*. Scroll to the bottom and uncheck the “*Use page prediction...*” option.

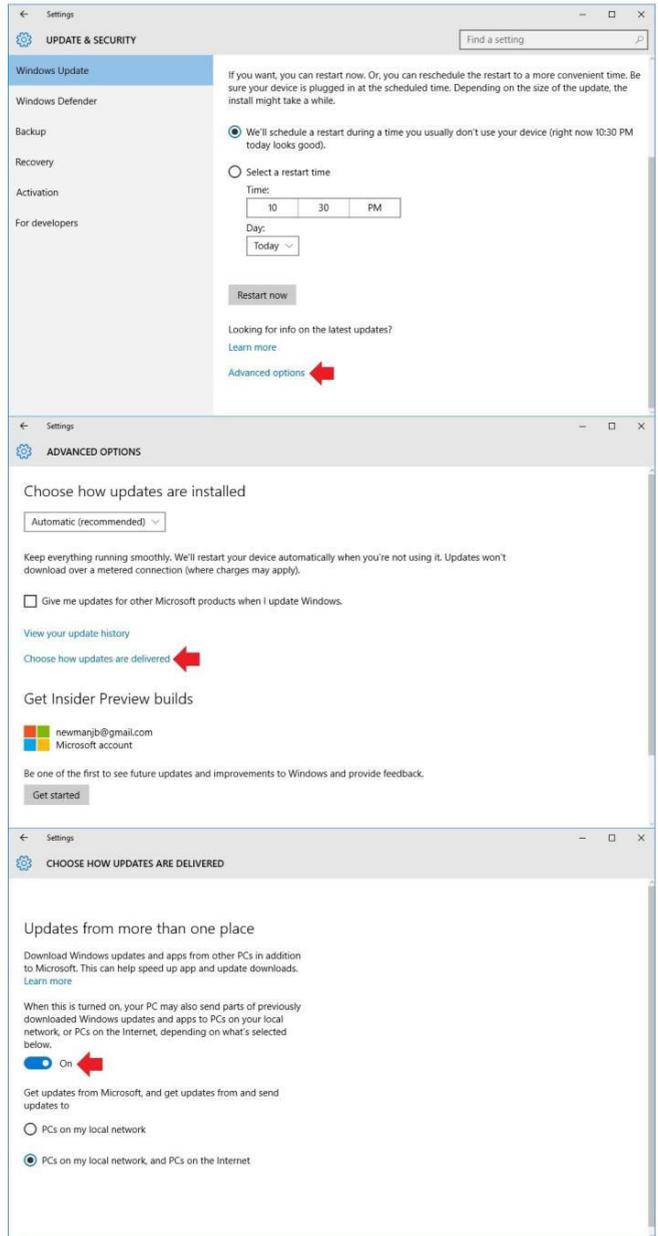
Get updates from and send updates to other PCs on the Internet to speed up app and Windows update downloads.

When your PC needs updating, Windows 10 can download small portions of the update from other PCs—both on your local network

and from random users over the Internet—and those PCs can download bits of the update from you. This peer-to-peer distribution method (go.pcworld.com/w10stopbandwidth) can speed the download process and prevent Microsoft's servers from getting overloaded, but it can take up bandwidth and eat into data plans. Disable this feature if your Internet service has data caps or slow speeds.

After setup, you can turn off peer-to-peer updates through *Settings > Updates & Security > Windows Update*. Click on Advanced Options at the bottom of the page, then click Choose How Updates Are Delivered. In this menu, slide the toggle to Off.

One last thing: Express settings don't cover all cases of privacy and data collection in Windows 10. To take full control, complete the setup, then head to *PCWorld's* step-by-step Windows 10 privacy walkthrough (go.pcworld.com/w10privacy). 🔌





Excel: 5 timesaving power tips

BY JD SARTAIN

THERE'S NO SUCH thing as too fast when you're crunching numbers on deadline in Excel. Any of these power tips will speed up your tasks.

1. **FORMULATEXT()** adds notes to formulas

If you and your colleagues share spreadsheets, it's nice to have notes that explain what your formulas are doing (plus a copy of the formula). Some organizations even require it, especially if you're a programmer or analyst.

plus the comment, inside quotes inside parentheses, at the end of your formula in D5. (Note: You would not put it at the end of the Reference in E5.)

For example, move your cursor back to cell D5 and press Function key F2 (to edit your formula). Then type **+N("your comments here")** at the end of your formula (with no spaces). And, if you'd like (although it's redundant), copy and paste the formula down to D15 and E15.

3. Case Functions fix upper- and lowercase messes

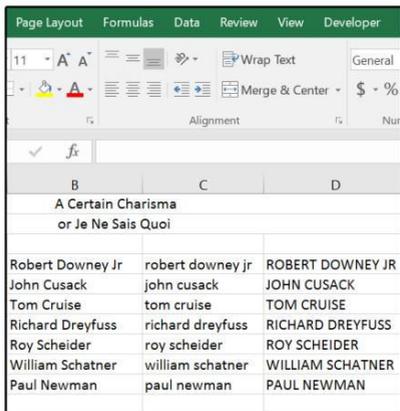
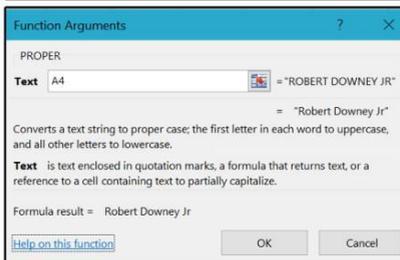
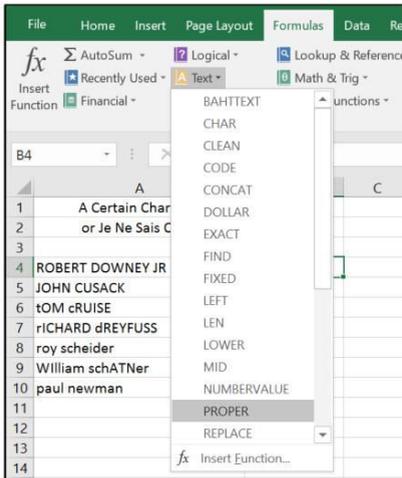
Have you ever typed an entire paragraph with the caps lock key on? In Word, the solution is an easy shortcut key (Shift+F3 repeated/cycled until the correct case displays). In Excel, it's a simple function: The UPPER() function converts all characters to uppercase. The LOWER() function converts all characters to lowercase.

Pop quiz: How does one convert upper- or lowercase, or a mixture of both, to what typographers call the Title, Name, or Sentence case? The command in Excel (which is also the preferred term) is Proper case, or PROPER() when written as a function.

In the sample spreadsheet on the next page, the names are entered in various upper-, lower-, and proper-case formats. Use the PROPER() function to repair these mistyped names: Move your cursor to cell B4,

D	E
Over/Under Est Budget	Over/Under Est Budget
	Formulas
-280.00	=SUM(B5-C5)+N("subtracts Actual Costs from Esti
122.00	=SUM(B6-C6)+N("subtracts Actual Costs from Esti
200.00	=SUM(B7-C7)+N("subtracts Actual Costs from Esti
65.00	=SUM(B8-C8)+N("subtracts Actual Costs from Esti
50.00	=SUM(B9-C9)+N("subtracts Actual Costs from Esti
-20.00	=SUM(B10-C10)+N("subtracts Actual Costs from E
50.00	=SUM(B11-C11)+N("subtracts Actual Costs from E
270.00	=SUM(B12-C12)+N("subtracts Actual Costs from E
-65.00	=SUM(B13-C13)+N("subtracts Actual Costs from E
-136.00	=SUM(B14-C14)+N("subtracts Actual Costs from E
256.00	=SUM(B15-C15)+N("subtracts Actual Costs from E

Use the N function to insert comments at the end of your formulas.



Use the Case

functions UPPER(), LOWER(), and PROPER() to repair case typing errors.

Proper.

The Function Arguments dialog box will appear. In the Text field, enter or point to cell A4, then click OK. Copy B4 down through B10 and notice how the PROPER() function has repaired all the mistyped names in this list.

Next move your cursor to cell C4 and enter the LOWER() function, which you can find in the same Text drop-down menu or enter it manually in cell C4: **=LOWER(B4)** and press Enter.

Move your cursor to D4 and enter the Upper function in this cell, or type **=UPPER(B4)** and press Enter. Copy cells C4 and D4 down thru C15 and D15. Now each name in each list is displayed correctly. Note that these functions also work for imported or copied text.

then click *Formulas > Function Library > Text*. From the Text drop-down, select

4. Transpose feature to rearrange columns and rows

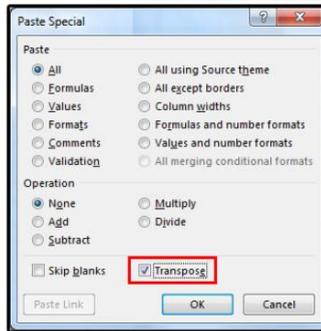
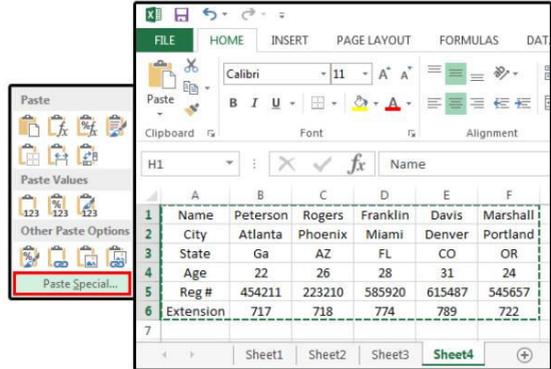
All super users know that in Excel, fields are placed in columns and records are placed in rows.

However, sometimes you inherit a spreadsheet from a rookie who has it backward. Retyping all that data is out of the question, and using copy/paste one row at a time would be horribly tedious. This doesn't seem like a big deal on a small spreadsheet, but imagine reorganizing 40 columns and 200 rows and you'll like this tip much better.

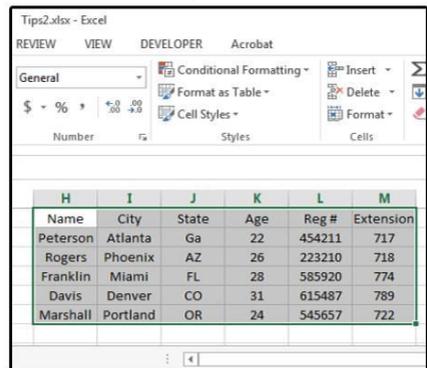
Highlight the data matrix you want to transpose (in our example, it's A1 through F6). Select Copy. Move your cursor to the new, target location. Go to *Home > Clipboard and click Paste > Paste Special*. In the Paste Special dialog box, check the Transpose field box, and click OK. And that's it! The data moves to the new location with the columns and rows transposed.

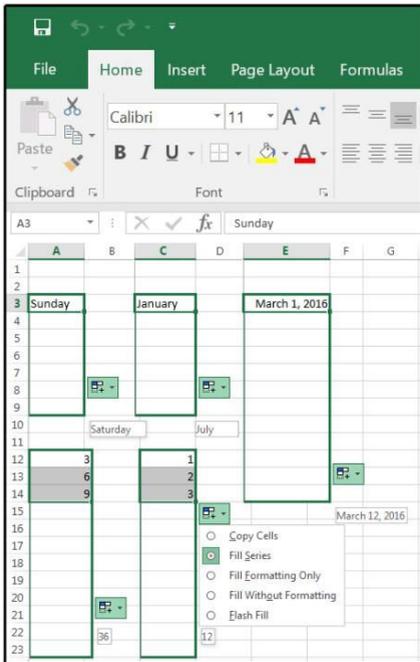
5. Save more seconds with Autofill

Everyone who handles series data should use Autofill to save typing and retyping for things that are always the same—for example, a list of consecutive numbers



The Transpose feature easily converts rows to columns or columns to rows.





3. Click and drag horizontally or vertically to copy the content down or over.

Notice the tag following your cursor as it drags. The info inside the tag changes to the next item in the series (in this case, the next day of the week).

4. When you release the left mouse button, the Autofill Options icon appears (overwriting the black cross). Click the down arrow and note the options available:

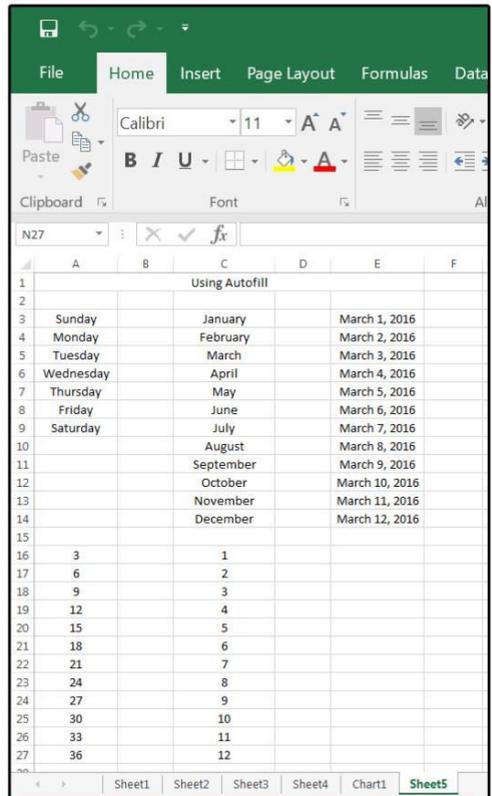
- Copy Cells
- Fill Series

Use Autofill to automatically enter items in a series.

or letters, months of the year, or days of the week.

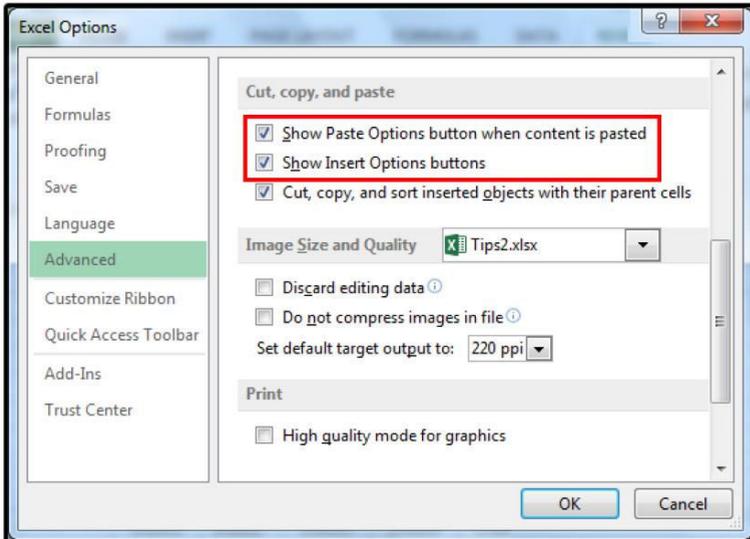
1. Enter a day of the week in cell A3.

2. Hover the cursor over the bottom right corner of the cell until it changes to a black cross.



How Autofill enters a sequence (automatically).

Autofill options.



- Fill Formatting Only
- Fill Without Formatting
- Flash Fill

If not already selected, click the Fill Series button.

The series displays (in consecutive order) up to the point where you stopped dragging the cursor.

Note: If the Autofill Options icon does not appear when you stop dragging the black cross, Select *File > Options > Advanced*. Scroll down to the *Cut, Copy, And Paste* section.

You'll see these three options with radio buttons:

- Show Paste Options Button When Content Is Pasted
- Show Insert Options Buttons
- Cut, Copy, And Sort Inserted Objects With Their Parent Cells

Ensure that the first and second buttons are both clicked on. (The third button is optional.) 



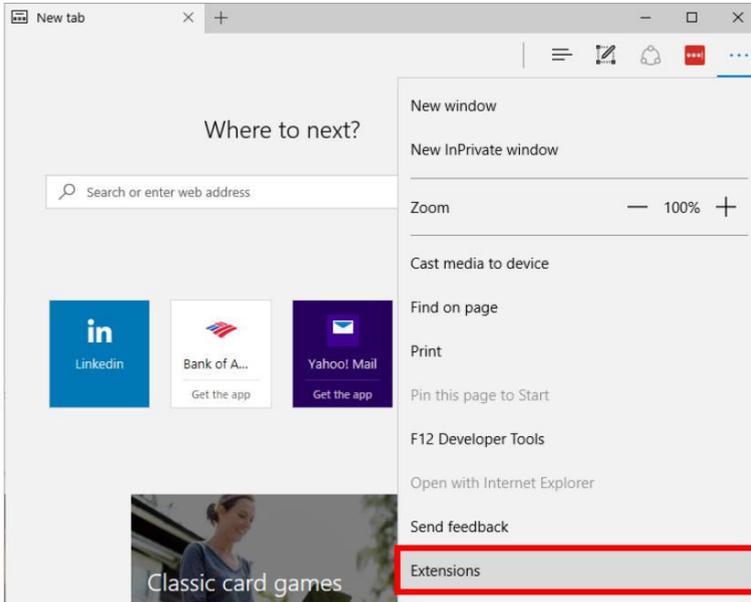
How to install Microsoft Edge browser extensions

BY IAN PAUL

THE ANNIVERSARY UPDATE for Windows 10 has been rolling out, and with it comes the ability to install browser extensions on Microsoft Edge (go.pcworld.com/w10edge).

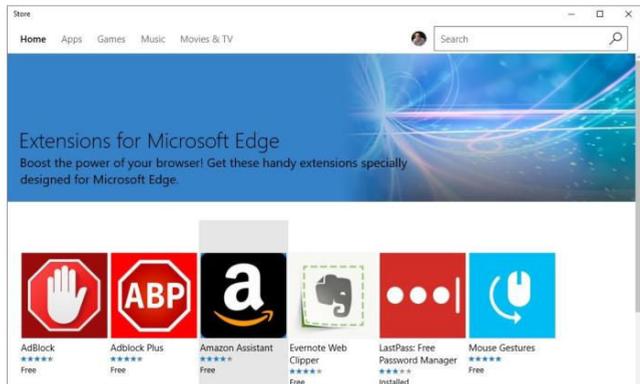
The new feature is just one of many tweaks that Edge needs to compete with more popular browsers such as Google Chrome and

Mozilla Firefox. At this writing, the number of extensions available for Edge are very limited, but you'll find a few notable ones, including AdBlock, AdBlock Plus, LastPass, and Pocket.



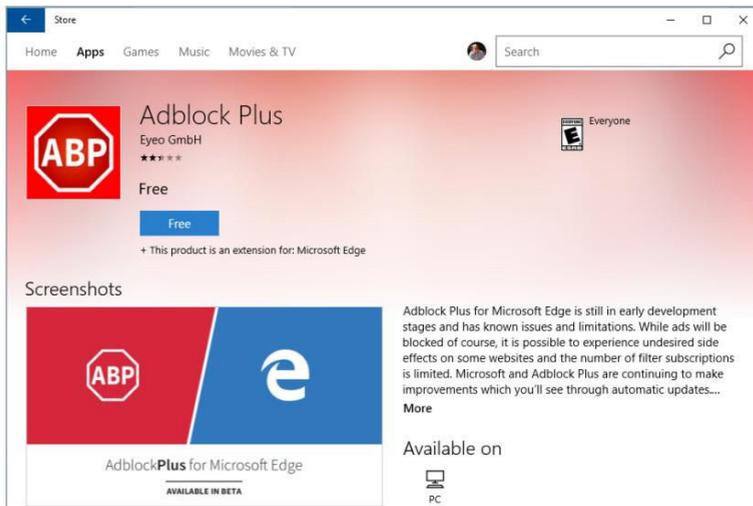
Once the Anniversary Update rolls out to your PC, here's how to download and install extensions in Edge.

First, open Edge and click on the menu icon (three horizontal dots) in the upper right corner. Next, select Extensions from the drop-down menu. This will open a second panel that will show any extensions you already have installed. Click the link labeled Get



Extensions From The Store.

The Store app will now open on the dedicated extensions page with all the various extensions you can install in your browser. From here on out, installing extensions works the same way as installing Store apps.



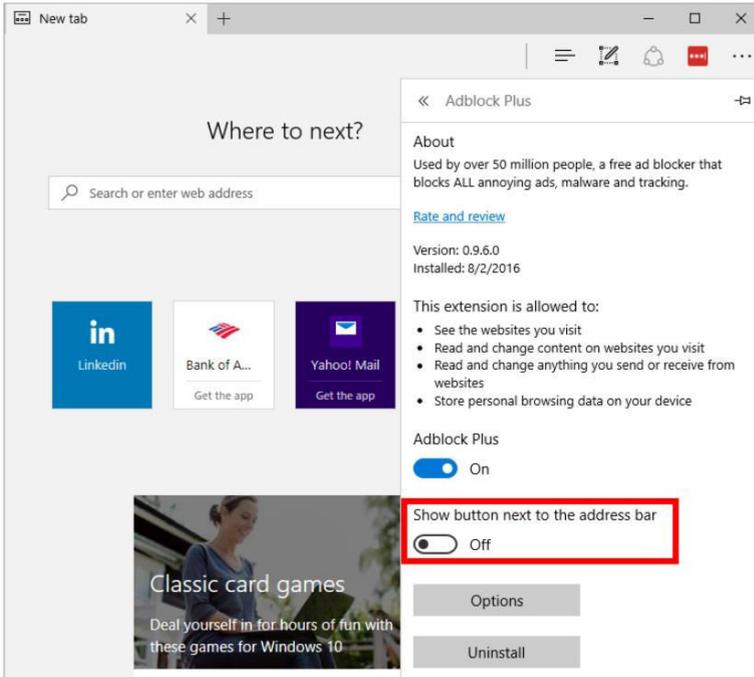
Let's say you wanted to install Adblock Plus. First, click on the extension's listing, and you'll come to its page in the Store. Next, click the Free button and it will install.

Once it's ready, Action Center will send out a toast notification letting you know it's available. The next time you're in Edge, the browser will ask you if you want to turn on the extension or leave it off. If you want to enable it, click Turn It On.

See it

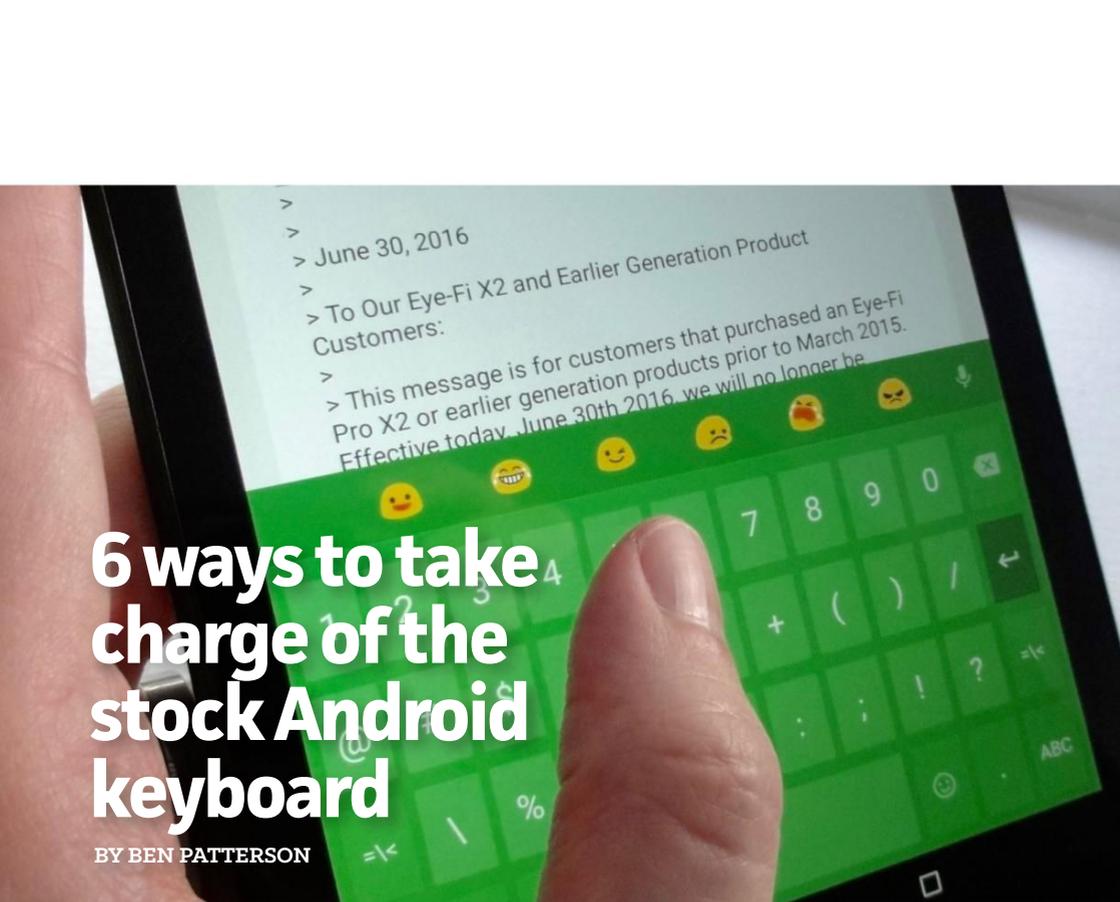
Now the extension is working—but you won't see it next to the address bar like you would in Chrome or Firefox. Microsoft decided against automatically cluttering up your browser chrome with add-on icons. If you want to see the icon, click on the three horizontal dots again and select Extensions.

You have to explicitly authorize extensions to appear next to the address bar.



Next, hover over AdBlock Plus (or whichever add-on you've installed) and click on the settings cog icon. On the next screen, click the slider labeled Show Button Next To Address Bar so that it's in the On position. You should now see the extension icon in your browser. This screen is also where you'd go to enable or disable any extension-specific options.

That's all there is to installing and managing extensions in Edge! Enjoy. 🖱️



6 ways to take charge of the stock Android keyboard

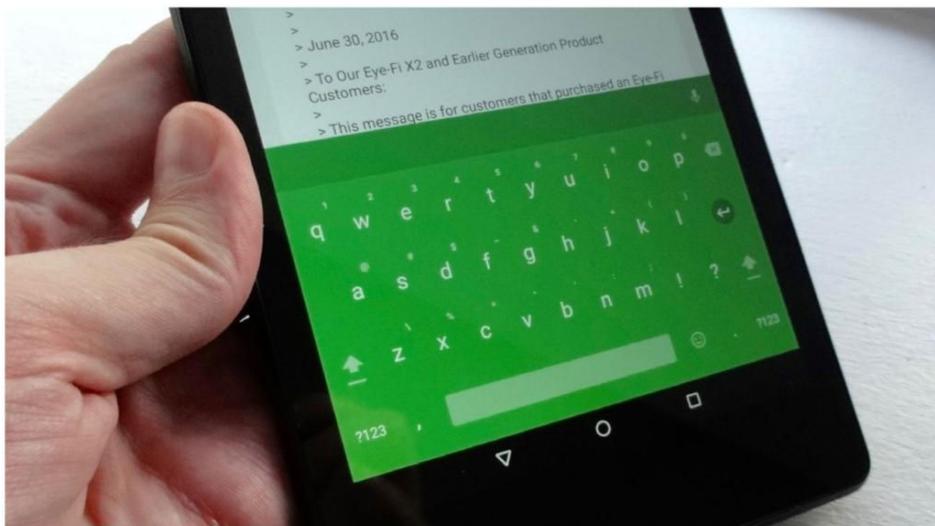
BY BEN PATTERSON

SURE, YOU'VE GOT plenty of choices when it comes to picking a new keyboard for your Android phone, but you shouldn't overlook the growing list of customization options available on the "stock" Android keyboard.

Not only can you change the color of the keypad, you can also create your own background using an image from your camera roll. You can even toggle key borders on and off, raise or lower the height of the keyboard, change the timing of a "long-press," get easier access to your favorite emojis, and more.

Change your keyboard's theme and background

Back in the early days of Android, the stock keyboard was something of an ugly duckling, with boxy, chunky keys and a single white-on-black theme.



Luckily, the Android keyboard got a makeover a couple of years ago, complete with a sleek new look and a quartet of grayscale color schemes. Today, the number of Android keyboard themes available has expanded to 15, plus the option to use a snapshot on your camera roll as a keypad background.

Tap *Settings > Language & Input > Google Keyboard > Theme* to see the menu of available keyboard themes—everything from black and red to green and pink—and tap an option to make the change.

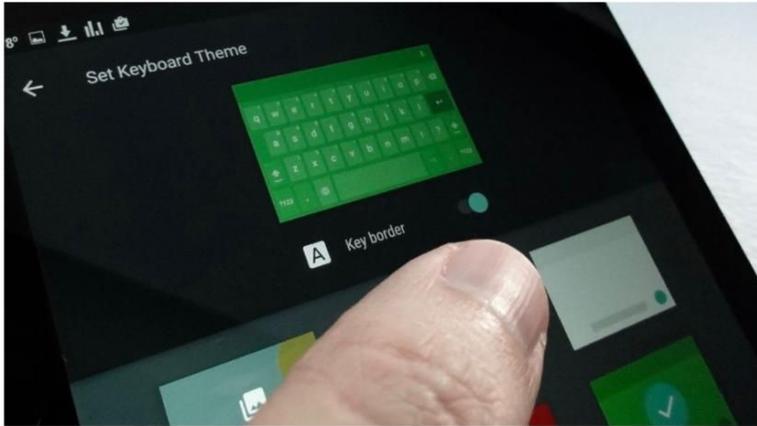
To use your own picture as a keypad background, tap the My Image option near the top. Once you've given Google Keyboard access to your photos (just tap Allow when prompted), pick an image from your photo library, crop the image and use the slider to adjust the brightness of the background. Finally, select the new background from the Set Keyboard Theme screen.

Add borders to the keys

When Google gave the Android keypad its sleek “material design” makeover, one of the big changes was the elimination of outlines for

Ready for a change? Just pick a new color theme for your Android keyboard.

individual keys; instead, letters, numbers, and symbols simply appeared to be floating on the keypad. But if you miss seeing a border for each key, there's an easy fix.



Just toggle the switch to get those old-school key borders back.

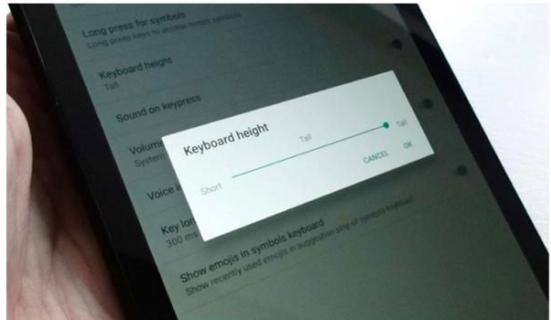
Just go back to the Set Keyboard Theme settings (*Settings > Language & Input > Google Keyboard > Set Keyboard Theme*), then toggle the Key border switch.

Go back to the keyboard, and you'll see translucent borders for each key—and if you ask me, the effect looks pretty good.

Raise or lower the height of the keyboard

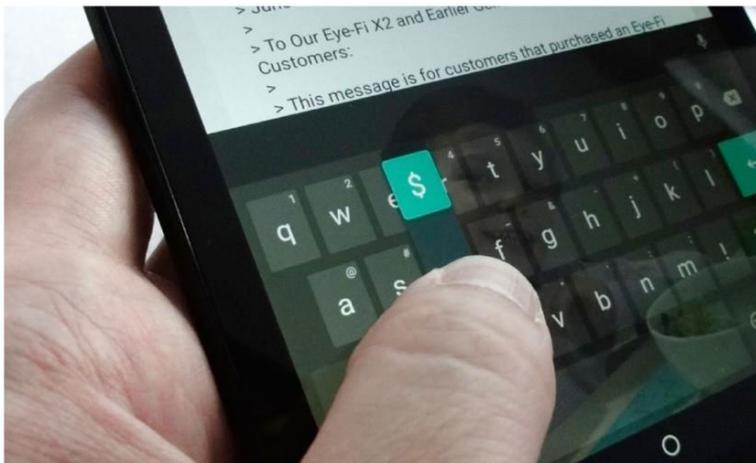
By default, the stock Android keypad takes up about the bottom 40 percent of the screen. If you want the keyboard to be a little roomier—or, on the flip side, if you want to shrink the keypad a tad—there's an easy way to do it.

Tap *Settings > Language & Input > Google Keyboard > Preferences > Keyboard Height*, then use the slider to pick a new setting. The Tall setting, for example, expands



Use the slider to raise or lower the height of the “stock” Android keypad.

You can save yourself a keystroke by enabling the Long press for symbols setting.



the keypad to about 45 percent of the display, while Short confines the keyboard to the bottom third of the screen.

Long-press to type symbols

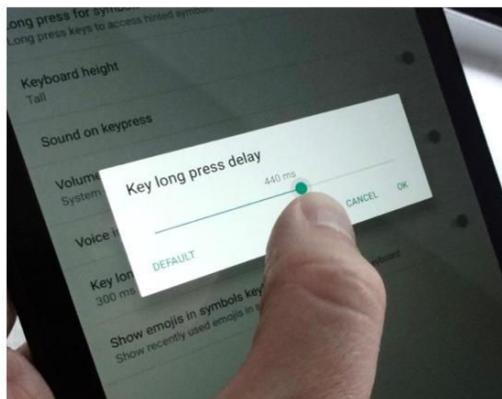
Here's a great setting for anyone sick of having to tap the ?123 key to access the symbol keys. Tap *Settings > Language & Input > Google Keyboard > Preferences*, then toggle on the Long press for symbols switch.

Now, go back to the keypad; when you do, you'll see little symbol icons in the corners of each letter key. Just tap and hold a key to type the symbol in the corner of the key you pressed, no extra keystroke required.

Bonus tip: If you'd rather skip tapping keys altogether, try swiping to type (go.pcworld.com/gesturetyping) instead.

Change how long a Long press takes

By default, you must hold a key about



300 milliseconds (or three-tenths of a second) for the Android keypad to register your keystroke as a Long press. If 300 milliseconds sounds a little too long—or too short—for you, give this setting a try.



You can reveal shortcuts to your favorite emoji with a single tap.

Tap *Settings > Language & Input > Google Keyboard > Preferences > Key Long Press Delay*, then pick a setting using the slider; 100 milliseconds (just a tenth of a second) is the shortest, while 700 milliseconds (nearly a whole second) is the longest.

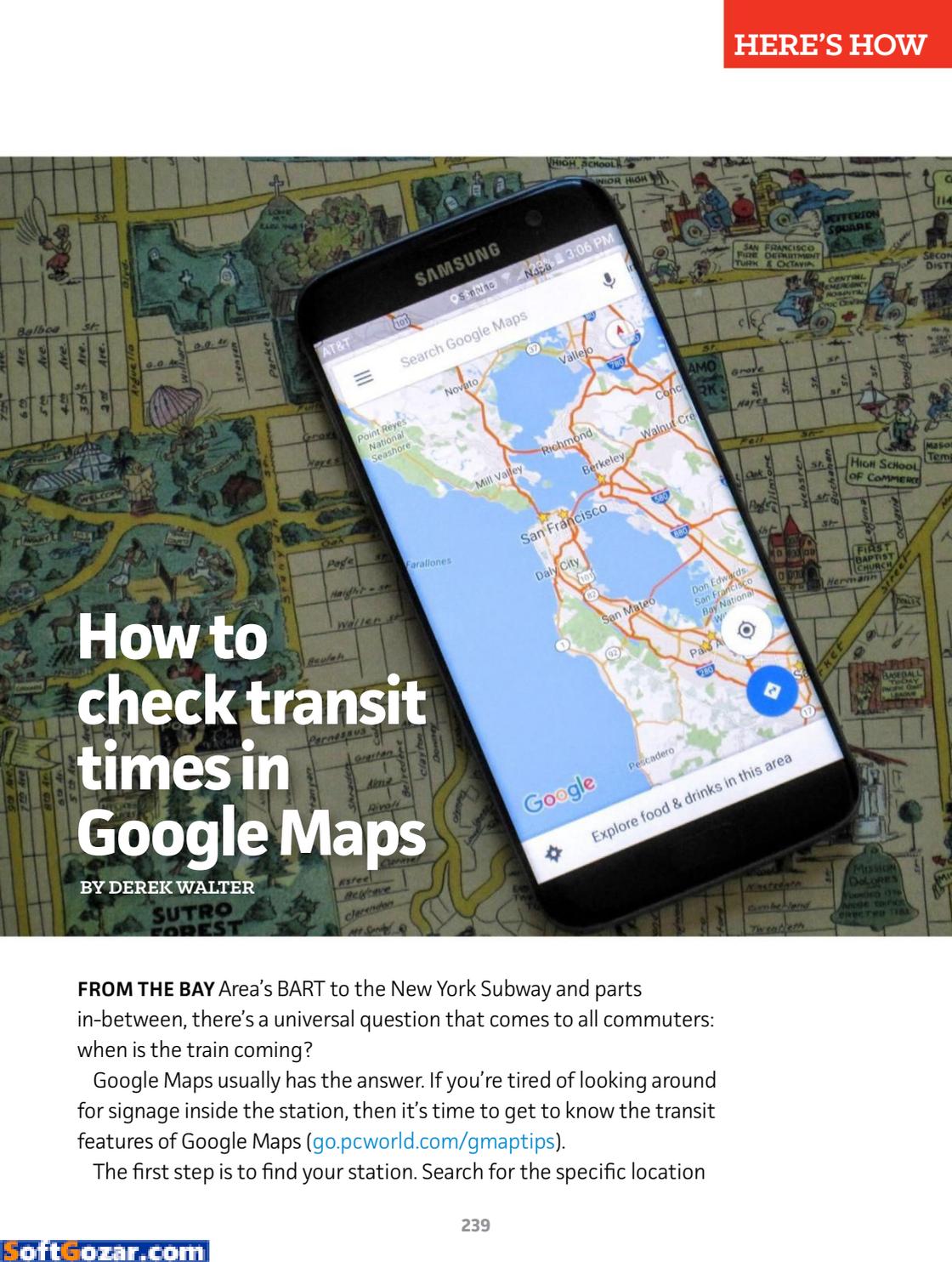
Get shortcuts to your favorite emojis

If you can't resist ending a text message with a smiley face, there's a nifty keyboard setting that'll quickly put your most-used emojis at your fingertips.

Tap *Settings > Language & Input > Google Keyboard > Preferences*, then toggle on the Show Emojis In Symbols keyboard setting.

Now, when you tap the ?123 key—you know, the key that calls up the symbols keypad—you'll see six of your favorite emojis appear in the suggestions strip just above the keyboard.

Bonus tip: You can easily create keyboard shortcuts for just about any word or phrase you want (go.pcworld.com/createkeycuts). 📱



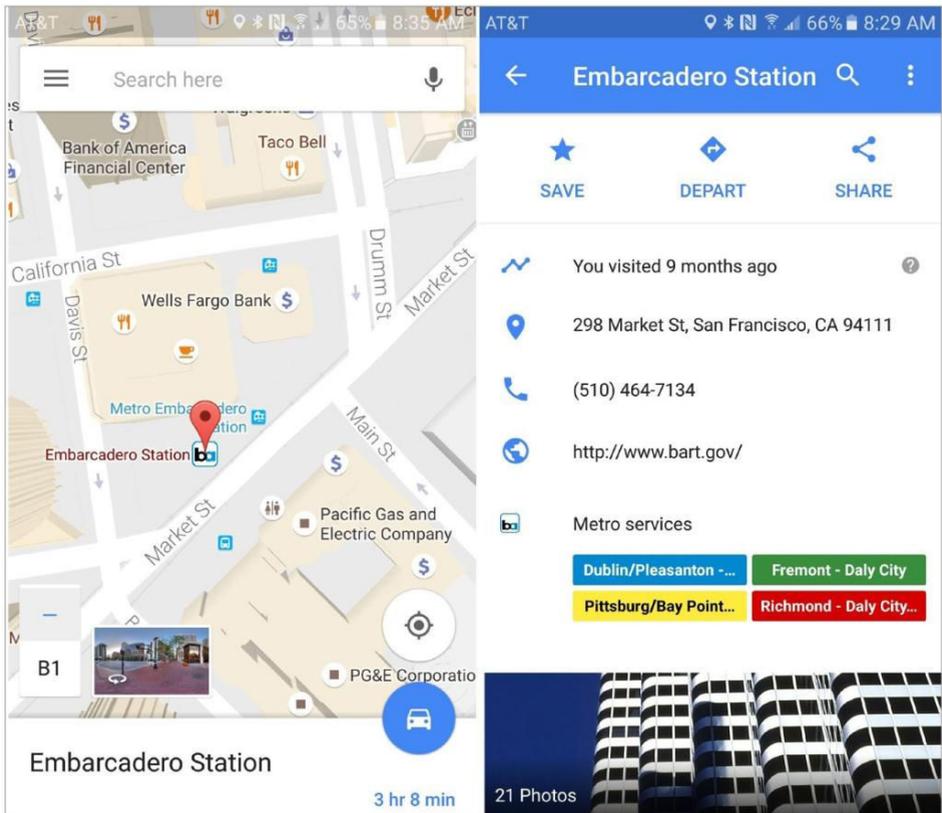
How to check transit times in Google Maps

BY DEREK WALTER

FROM THE BAY Area's BART to the New York Subway and parts in-between, there's a universal question that comes to all commuters: when is the train coming?

Google Maps usually has the answer. If you're tired of looking around for signage inside the station, then it's time to get to know the transit features of Google Maps (go.pcworld.com/gmaptips).

The first step is to find your station. Search for the specific location

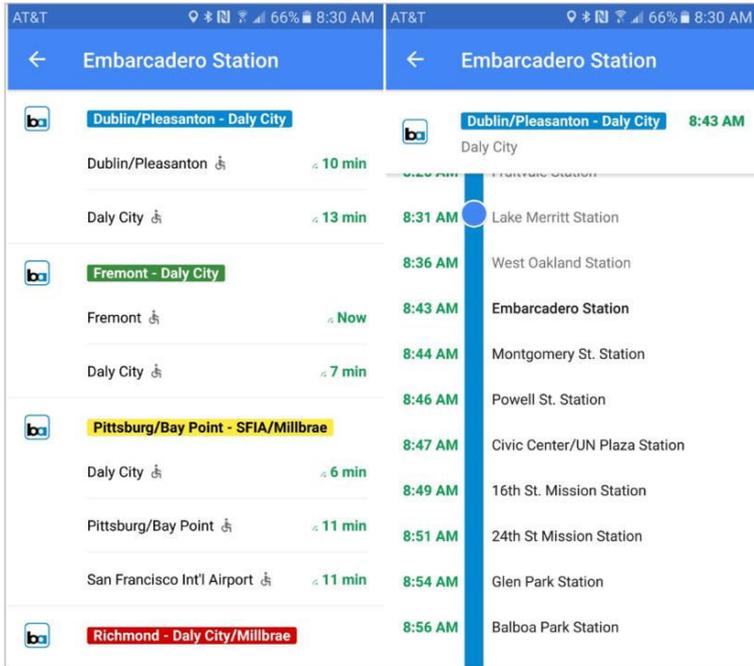


Find your station and get a quick overview of which transit lines run there.

or find it on your map if you're already there. Then tap on that location to pull up its profile page.

Scroll down and you'll see the specific transit lines that operate here. Then, touch on the section with the name of that city's service. In our example, it's Metro Services. You'll then see the routes and arrival times for specific train lines. If you touch one of them, you'll see exactly where the train is at and the where else it needs to stop before arriving at your location.

You can use this to find out how long you have to wait at the station



You can see a specific list of stations and find out where the train is currently located.

or to get an idea of how quickly certain trains run before heading out for your trip. The transit and bus times for most major and mid-sized cities are in Google Maps, so there shouldn't be any mystery about what your wait time should be. 🔌

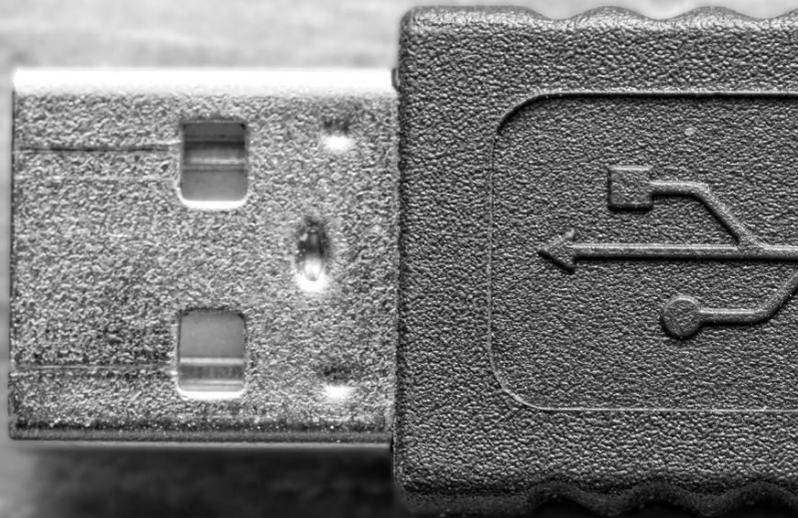
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How to adjust your AutoPlay settings in Windows 10

FEW FEATURES IN Windows have as colored a history as AutoPlay (go.pcworld.com/w10autoplay#-). In its early days, the setting was infamous for passing viruses from errant USB drives to PCs. In more recent versions of Windows, AutoPlay is off by default to prevent malicious files from automatically executing on a PC.

AutoPlay is handy because it tells Windows to automatically carry out a specific action when you plug in some kind of removable media such as an SD card, a USB drive, or an external CD player. AutoPlay can be set to automatically import photos or videos, play any media, open File Explorer, or do nothing at all.

Even in the age of Windows 10, the best practice for AutoPlay is to leave it off or to have it ask you what to do every time you insert a device. If that doesn't work for you, the next most benign step you can take is to set AutoPlay to open File Explorer. That way you can still see what's on



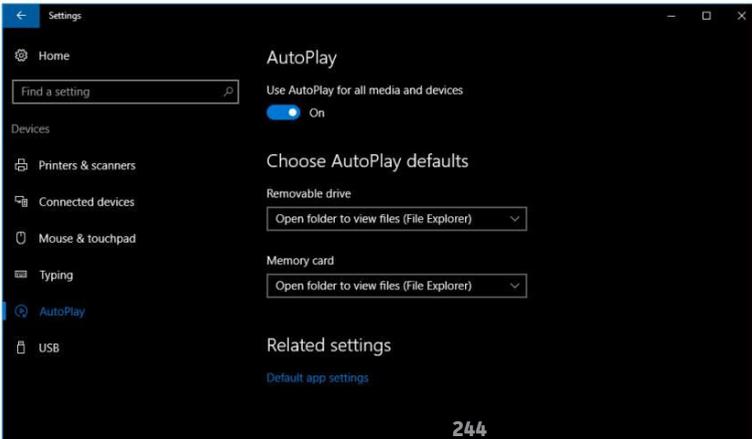
the USB stick, which is probably an action you would've taken anyway.

Here's how it works in Windows 10. This example uses the Anniversary Update, but previous iterations offer similar settings.

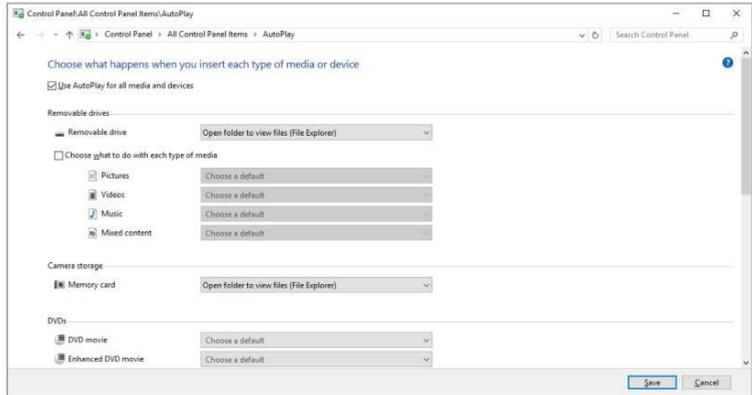
Go to *Start > Settings > Devices > AutoPlay*. At the very top of the main screen there's an On/Off slider that activates or deactivates AutoPlay. Below that is the subheading Choose AutoPlay Defaults.

This section may change depending on your machine's configuration. On my laptop I have options to decide what to do with a USB removable drive (flash drive, external hard drive, etc.) and a memory card.

In our example, we're setting each option to open the files in File Explorer for immediate viewing. To do that, select each drop-down menu



and choose Open Folder to View Files (File Explorer). If you'd rather open File Explorer yourself, choose the Take No Action option.



If you need more granular

control over what AutoPlay does with each type of removable media, you'll find that in the Control Panel. Open the utility by right-clicking on Start and then selecting Control Panel from the context menu.

Next, set the View By option in the control panel to Large Icons. Then select AutoPlay at the top of the window. From here you can tell Windows to do specific things based on the type of media and the files it has.

For example, you can tell a removable drive to automatically import photos but take no action for videos. There are numerous options you can set using Control Panel, but again it's important to understand that using AutoPlay at all can be an easy way to end up with an infected PC.

Of course, there's more to USB security than just disabling AutoPlay. Check out Stack Exchange for a short discussion about threats from external media (go.pcworld.com/autoplayusbstick) beyond using AutoPlay. The most important thing to know is that you should never plug a USB device into your computer if you don't trust it or don't know where it came from.

Even if you do trust a USB device (such as one that you own), you still may not be able to treat it as safe, depending on where it's been. If you used a personal USB drive at work and then brought it home to insert in your personal machine, watch out. You never know what kinds of horrible things are lurking in corporate networks, your local Internet cafe, or even your friend's house. 🔌

AutoPlay settings in the Control Panel in Windows 10 (Anniversary Update).



You can safely use Windows 7 until 2020, but I won't be answering your questions

Eva R. doesn't like Windows 10. She asked how long she can keep using Windows 7.

Microsoft angered a lot of people by tricking them into upgrading to Windows 10. But those who successfully resisted can continue to use Windows 7 for the rest of the decade.

In one sense, Microsoft has already stopped supporting Windows 7,

but not in a way that should worry you. Mainstream support ended in January of 2015. But that only means Microsoft won't add new features or change the user interface. I suspect most current Windows 7 users are probably thankful that the look and feel won't change.

The real problem comes when Microsoft ends Extended support, which will happen on January 14, 2020. After that day, the company will stop sending out bug fixes and security patches. Without those, Windows 7 will be more vulnerable to malware and other forms of attack. I strongly recommend that you stop using Windows 7 before that date.

Windows 8.1 users have considerably more time. Mainstream support ends in 2018; extended, 2023.

In my opinion, these are reasonable dates. Like everything else, operating systems age, and eventually become unsound. And the computer hardware you now use may be showing signs of age by then as well.

Speaking of things that don't last forever...

I took over *PCWorld's Answer Line* column in 1997. That's a long time ago. In those days, *PCWorld* was spelled as two words (*PC World*), most people read it on paper, and my first column contained an answer about Windows 95's handling of DOS filenames.

After nineteen years, eight Windows versions, and an estimated 55,000 reader questions (most of which I answered personally), it's time for me to move on. And time for me to thank every person who ever sent me a question. I couldn't have done this column without you.

I'm delivering this blog into the very capable hands of Josh Norem. He's a veteran of *Maximum PC*, with Q&A experience, and I'm looking forward to seeing what he does with *Answer Line*.

I'd like to close the column with a piece of advice: Back up your data files every day. It's easy (go.pcworld.com/easybackups), and judging from the letters I've received, almost no one does it. 

Tech Spotlight

A video showcase of
the latest trends



Watch the
video at
go.pcworld.com/modobagvid

IDG.tv

Riding the **Modobag**

» Modobag is a carry-on suitcase with a motor that you can ride. We took it for a test drive around the IDG office.