PCWorld

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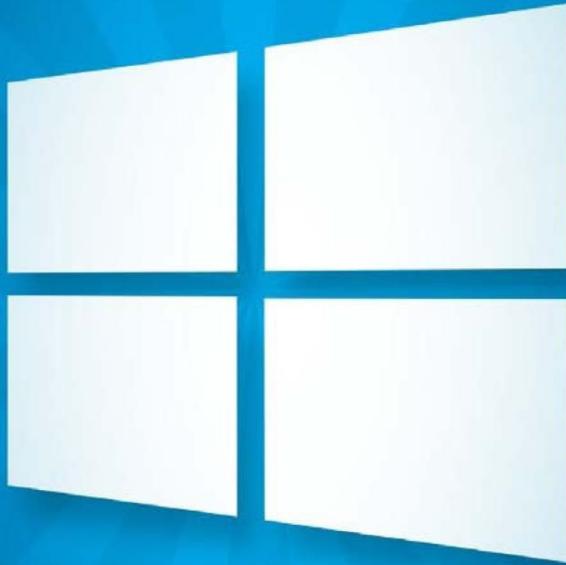
WINDOWS 10
ANNIVERSARY UPDATE

WE PICK THE 13 BEST NEW FEATURES

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NEWS

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Nvidia's beastly GeForce GTX 1080 and GTX 1070: The 10 key things you need to know

BY BRAD CHACOS

NVIDIA'S LONG-AWAITEd GeForce GTX 1080 is real (geforce.com/ hardware/10series/geforce-gtx-1080) and it's spectacular—at least on paper. If you missed the big reveal, here are the 10 things you need to know about Nvidia's ferocious, cutting-edge GeForce GTX 1080 and the just-as-impressive GeForce GTX 1070.

1. Ludicrous speed

The most important thing to know: This thing is *fast*. *Ridonkulously* fast. "Faster than dual GeForce GTX 980s in SLI" fast, which handily beats Nvidia's flagship Titan X (go.pcworld.com/titanxreview), the most potent single-GPU graphics card ever released. During a demo, the new *Doom* topped out at roughly 200 frames per second at 1080p resolution, with all the graphics settings cranked. As I said in my initial coverage: Hot damn.

2. Ludicrous speed redux

Remember how I said the Titan X is the most potent single GPU ever released? That high-water mark is the new *midrange* for Nvidia's Pascal GPU architecture. The step-down GeForce GTX 1070 outpunches the Titan X too, according to Nvidia—though it never said exactly what was being compared.

3. Black magic

The secret sauce behind those jaw-dropping performance gains lies in the adoption of several cutting-edge technologies, all at once. After being stuck on the 28 nanometer transistor manufacturing process for four long years, Nvidia is building its Pascal GPUs on the 16nm process—a two-generation technological leap. What's more, the chips embrace advanced FinFET technology, as well as 8GB of an improved form of memory dubbed GDDR5X that allows for whopping 10Gbps speeds. No, that's not as fast as the cutting-edge high-bandwidth memory (go.pcworld.com/hibandwidthmem) found in AMD's Fury graphics cards, but HBM is currently limited to 4GB capacities and GDDR5X is still plenty speedier than the GTX 980's 7Gbps memory. You can find the full set of announced GTX 1080 tech specs on Nvidia's website (geforce.com/hardware/10series/geforce-gtx-1080) if you're interested.

4. Power efficiency

Beyond enabling eye-watering performance, those technological leaps have helped the Pascal architecture become Nvidia's most energy-efficient GPU yet: Nvidia says the GTX 1080 boasts three times the efficiency of the Maxwell GPU-based Titan X. Yet despite offering more performance than dual GTX 980s, the GTX 1080 only demands 180W of power over a single 8-pin power connector. That seems like it shouldn't be possible—powering a pair of GTX 980s demands the use of four 6-pin power connections, by comparison.

5. Overclocks like a beast

But then there's still plenty of overclocking headroom for people who want MOAR POWER hiding behind that modest power draw. While the GTX 1080 offers clock speeds hundreds of megahertz higher than the GTX 980 out of the box—with a max boost clock of 1733MHz—Nvidia showed a *Paragon* demo running on a GTX 1080 overclocked to a blistering 2114MHz. And it was air-cooled, *and* still running at a comparatively chilly 67 degrees Celsius.

The move to a 16nm process gives Nvidia's newest GPU an insane jump in performance and efficiency.

6. **Simultaneous multi-display**

Nvidia's loading up the GTX 1080 with some new software tricks, too. Simultaneous multi-display improves how games look on multiple displays or VR headsets, using technological tricks to prevent the distortion that naturally occurs when you're projecting an image onto multiple displays tilted at slightly different angles. (Think of a straight line drawn on a piece of paper, then how it appears when you fold that paper instead—angled, rather than straight.)

Another one of SMP's tricks can supercharge traditional one-monitor gaming, too. In a nod to the way VR headsets render scenes, SMP renders the edges of a scene at lower pixel resolution, since it'll get all warped and scrunched together through a VR headset's lenses anyway. Since the GPU's rendering far fewer pixels, you see a big frames-per-second performance boost. You can still use that technology on a single monitor and see similar performance gains, and with less visual degradation than you'd expect. I played a demo of Cyan Worlds' Obduction (at 4K resolution) that let you toggle SMP on and off; in a scene where frame rates hovered around 42fps, enabling SMP jacked it up to the monitor's 60fps maximum, and you couldn't see any blurring or artifacts around the edges of the screen unless you were standing still in-game and really looking for it. The developers

Obduction's simultaneous multi-display demo.

said that enabling SMP can provide a 30 percent or higher frame rate boost in the game, depending on the scene. Exciting stuff, all built on the shoulders of Nvidia's multi-resolution shading (go.pcworld.com/nvidiamultires).

A scene from *The Witness* captured in Nvidia's Ansel.

7. Ansel

Nvidia's looking to bring more art to screenshots with Ansel, an in-game 3D camera utility that lets you capture screenshots and then manipulate numerous filters, brightness levels, and other options to create the gaming masterpiece of your dreams. You can even use a free camera mode in Ansel to go places you normally wouldn't be able to travel in-game, and at crazy high resolutions—up to 61440x34560, even if the game doesn't support it. You can even take 360-degree "bubble" pictures that you can then check out on your HTC Vive or Google Cardboard headset.

Awesome stuff, *if* it takes off, since developers need to explicitly

enable support for Ansel. Existing games like *Witcher 3* and *The Division*—both of which already featured Nvidia GameWorks tools—are slated to receive Ansel support, though, as does Cyan's *Obduction*.

8. Tweaked design

Nvidia's Founders Edition cards (go.pcworld.com/foundersedition)—previously known as reference cards—sport a new aesthetic that largely mimes the look of the GTX 900-series reference cards, down to the aluminum exterior and transparent front panel, but with a more aggressively angular design that brings tessellation triangles to mind. The GTX 1080 and GTX 1070 Founders Edition cards will be sold directly from Nvidia…

9. Price and launch date

…for slightly more than you might think. While *reference card* previously meant "entry-level" (despite the stunning build quality of Nvidia's reference boards), the GTX 1080 Founders Edition costs $700 at launch, compared to an MSRP starting price of $600 for the GTX 1080. The GTX 1070 will cost $450 for an Nvidia Founders Edition at launch in June, or just $380 at its suggested starting price—and yes, that's despite outpunching a Titan X.

10. What's AMD up to?

Finally, the most important thing to keep in mind with the GeForce GTX 1080 is that we haven't seen details about Radeon graphics cards based around AMD's new Polaris GPU (go.pcworld.com/amdpolaris) yet, which is also moving to a smaller (14nm) manufacturing process bolstered by FinFET. Early demos with low-power Polaris GPUs suggest AMD's seeing a major efficiency bump from the transition too, though Team Red's yet to tease anything with the raw firepower of the GTX 1080 and 1070. It's going to be an exciting couple of months for gamers. ⏻
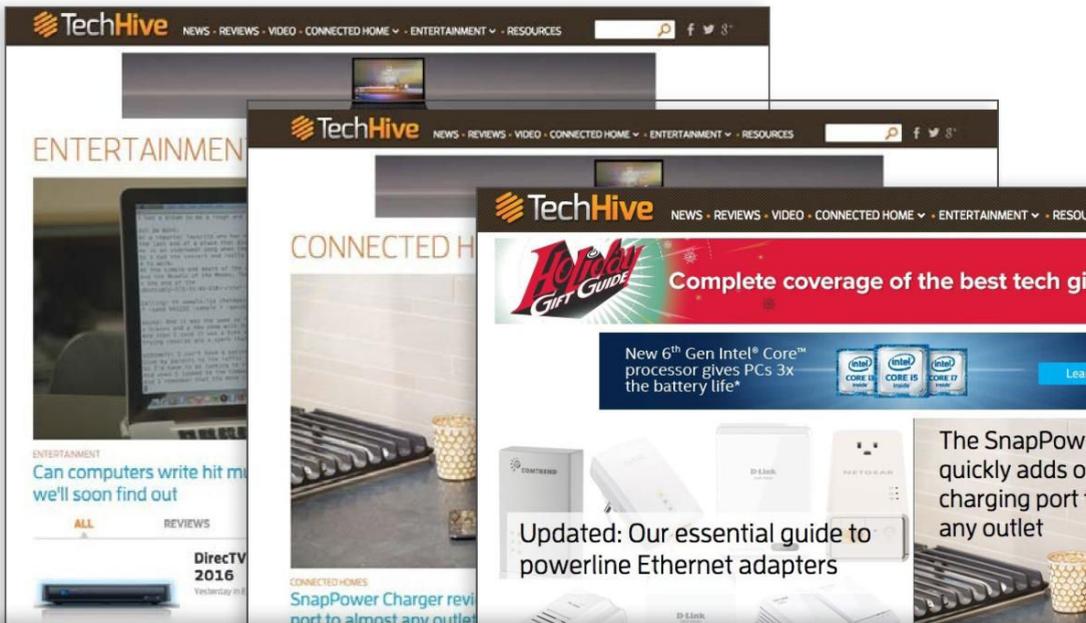
Windows 10 adoption hits 300 million as Microsoft's free upgrade will end soon

BY MARK HACHMAN

MICROSOFT SAYS THAT 300 million devices now run Windows 10. And if yours isn't among them, time is running out.

Recently, Microsoft began showing potential customers of Windows 10 the carrot as well as the stick, touting Windows 10's success but also warning that the free upgrade offer would expire in a couple of months. If consumers don't upgrade their PCs from Windows 7 or Windows 8.1 by July 29, Microsoft will charge $119 for a copy of Windows 10 Home when they eventually do.

First, however, Microsoft demonstrated the extent to which

Windows 10 had already progressed. Windows 10 is now on 300 million active devices, according to Microsoft; Microsoft said in its April earnings call that Windows 10 was on 270 million devices, and in January executives said it was on "over 200 million devices." The goal,

according to Microsoft, is to have over 1 billion devices—phones, tablets, PCs, servers, and embedded products—actively using Windows 10 on a monthly basis, Microsoft has said.

"If you've already upgraded to Windows 10—thank you. If you haven't upgraded yet—we hope you'll consider upgrading today," Yusuf Mehdi, the corporate vice president of Microsoft's Windows and Devices Group, said in a blog post.

Why this matters: Expect Microsoft to sound the drums of doom as we near that July deadline—both in the press as well as the PC. If you multiply the 300 million devices by $119, you get a whopping figure of over $35 billion—a very poor estimate, but the magnitude of the fees Microsoft would have charged for the upgrade. (Far fewer would have paid to upgrade than those 300 million device owners, but still.) Like the robocalls from candidates seeking your money, expect Microsoft to ping your older PC to upgrade now, before it's too late.

Windows 10's 'halo effect' on its apps

Microsoft also said that more consumers were latching on to Microsoft Edge, with 63 billion minutes spent last quarter alone. That's 50 percent more minutes than last quarter, Microsoft said. Apps that

come with Windows 10, including Groove Music, Photos, Movies & TV are seeing "millions" of active users per month, including more than 144 million people using Photos. More apps are appearing in the Store, including updated UWP apps from Vine, Hulu, Netflix, and Twitter. Over 9 billion hours of games have been played on Windows 10 since launch. Microsoft didn't provide overall app numbers, however.

Finally, Microsoft said that Cortana has fielded 6 billion questions since launch—not a fantastic number, as 6 billion questions divided over 300 million devices works out to about 20 questions overall.

Mehdi said that Microsoft was still expected to ship its Anniversary Update (see our feature on page 98) to Windows 10 this summer, which will include Windows Ink's pen-based interface and other goodies.

Most recently, a newscast was interrupted with an upgrade notification, as was a live Twitch stream.

Microsoft is also expected to keep digitally insisting that users upgrade to Windows 10, as the company has quietly made the upgrade from Windows 7 and 8.1 a "recommended update" for users. Microsoft has apparently tested several methods of pushing this update to users (go.pcworld. com/w10forcedupgrade), including countdown clocks and the like.

But these upgrades—accepted or not—have also been disruptive. Most recently, a newscast was interrupted with an upgrade notification, as was a live Twitch stream. Erik Flom was playing *Counter-Strike* in front of a reported 120,000 people when his computer spontaneously launched the upgrade process. Expect more of these sorts of stories as July nears. ⏻

Amazon launches the Kindle Oasis, a premium $290 e-reader with a love handle

BY JARED NEWMAN

AMAZON IS TURNING the e-reader into a luxury item with the new Kindle Oasis (go.pcworld.com/oasispreorder).

Starting at $280, the Kindle Oasis is Amazon's most expensive e-reader since the Kindle DX (go.pcworld.com/kindledxrev) from 2010. Amazon says its mission with Kindle is to "make the device disappear so you can lose yourself in an author's story," and in this case, that means making the device more book-like.

To wit: One side of the Kindle Oasis sports an extra-wide, extra-thick bezel, which seems like a nod to the spine of a paper book. Users can hold it in either hand, and the screen will flip around accordingly.

Amazon is also including a leather cover with the Oasis. Aside from just making the package look classier, the cover includes its own battery, which combines with the e-reader for up to eight weeks on a charge. Plugging in the Kindle Oasis with the cover attached will charge both devices, and the e-reader is smart enough to deplete the cover's battery before tapping into its own reserves.

Those flourishes aside, the Kindle Oasis is similar to 2014's Kindle
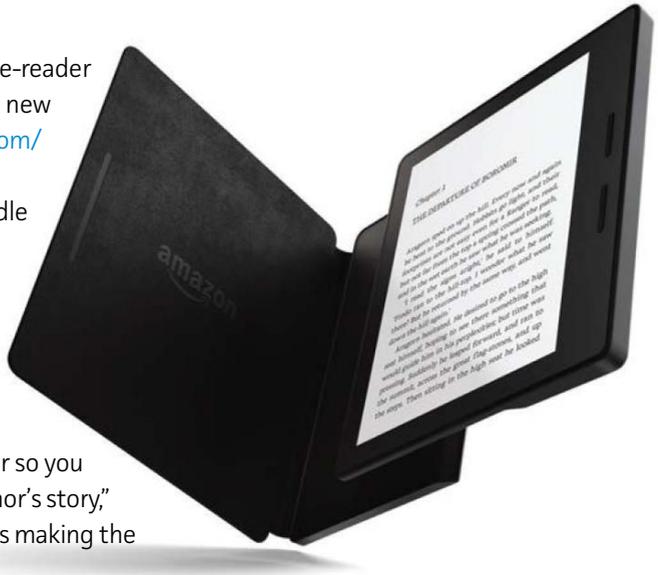
Voyage (go.pcworld.com/kindlevoyagerv), with a 6-inch 300 dpi display and 4GB of storage for holding thousands of ebooks. The Oasis should be brighter, however, with 10 LEDs compared to 6 LEDs in the Voyage. Its 0.29-lb. frame (without the cover) is also much lighter than any other Kindle. (Attaching the cover brings the weight up to 0.53 ounce, which is still lighter than most small tablets.)

Amazon hasn't given a precise release date for the Kindle Oasis, but is taking pre-orders now for shipping in the "coming weeks." As with other Kindles, Amazon charges an extra $20 to remove Special Offers ads from the device's lock screen. A 3G model (for downloading books without Wi-Fi) is also available for $70 more.

Meanwhile, Amazon still sells a basic Kindle for $80, the higher-resolution Kindle Paperwhite for $120, and the $200 Voyage with adaptive lighting.

Why this matters: For years, Amazon had been racing to the bottom on e-reader pricing as it tried to edge out rivals like Nook, Kobo, and Sony. Although the company still sells readers for cheap, it's also trying to appeal to ebook diehards at a premium. Amazon must have enjoyed some success on that front with the Kindle Voyage, given that the company is now charging even higher prices for the Kindle Oasis. ⏻

ASRock confirms rumors of 10-core Intel Core i7

BY GORDON MAH UNG

ASROCK, THE HONEY badger of motherboard makers, flagrantly outed Intel's most anticipated enthusiast chip of the year: a 10-core Core i7 CPU.

Sure, we've seen dribs and drabs of leaks for months, including Intel's own accidental disclosure (go. pcworld.com/intelleaks) of the Core i7-6950X recently, but no vendors had confirmed the actual core count until now.

"The most unmissable part of Intel Broadwell-E is the flagship Core i7-6950X, which will be the first deca-core processor for the commercial market," ASRock said in April in a press release (go.pcworld.com/asrockpressrelease) on its website.

Intel's Broadwell Core i7 lineup includes a 10-core Extreme Edition aimed straight at PC gamers.

And yeah, there's more—ASRock went on to confirm the rest of the lineup. "While this new CPU boasts a compelling 10-cores-and-20-threads architecture, users require a BIOS update for their motherboards to handle it; this update applies to the rest of the Broadwell-E gang, including i7-6900K, i7-6850K, and i7-6800K as well," the press release said. ASRock didn't spell out the specs of the others, but they're expected to be 8-core, 6-core, and 6-core, respectively.

Why this matters: Intel's Skylake CPUs (and Windows 10) have failed to buoy saggng computer sales since they debuted last year, so

the company has increasingly looked to gamers and hardware enthusiasts to move product. Nothing builds excitement like more CPU cores, which the Core i7-6950X has in spades.

More leaks than the Titanic

One can't help but wonder if all the leaks are somehow condoned by Intel to help stoke the hype-train engine. I asked Intel to comment on ASRock's confirmation and was given the boilerplate response that the company does not comment on unannounced product.

Intel had its own accidental (on purpose?) slip, when a newly posted webpage appeared to confirm that the Core i7-6950X would hit speeds of up to 3.5GHz and have 25MB of cache. That page has since been pulled.

MSI "leaked" news, too. In April, the company said its X99 motherboards were ready for Broadwell-E. MSI's press release, however, was far more coy and used screenshots and performance numbers from a Xeon chip instead. Gigabyte also quietly added "Support 2016 Q2 coming new CPU" (go.pcworld.com/gigabyteupdate) in a BIOS update pushed out in January.

So obviously, this has been the worst-kept secret. The only real

ASRock just confirmed that the upcoming Core i7 will have 10 cores.

Downloads for Intel® Core™ i7-6950X Processor Extreme Edition (25M Cache, up to 3.50 GHz)

Description	Type	OS	Version	Date
Intel® Management Engine (Intel® ME) software for systems based on 3rd generation Intel® Processors or above. Intel® Management Engine (Intel® ME) software 11.0.2.1002 for systems based on 3rd generation Intel® Processors or above.	Drivers	Windows 7 Enterprise, 32-bit* Windows 7 Enterprise, 64-bit* Windows 7 Home Basic, 32-bit* 37 more	11.0.2.1002 Latest	3/29/2016

No more matches

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unknown is how much Intel will charge for the CPU. When the chip first popped up on the leak radar, many people assumed the price would be $1,000.

Intel has basically charged a grand for its top-end processor since the days of the first quad-core Bloomfield Core i7-965 Extreme Edition. That price held when Intel added two more cores to the Core i7-990X. Several generations later, when Intel "gave" consumers two more cores still, for a total of eight in the Core i7-5960X, the price remained $1,000.

With the 10-core Core i7-6950X, though, there are indications Intel may ramp up the price to $1,500. Again, Intel has never confirmed nor talked about the CPU on the record, but rumors of the higher price have been hot and heavy since January.

Consumers are balking, not surprisingly, but Intel may have good reason for the increase. Intel's top-end Core i7 chips have always been repurposed Xeon chips with a few features turned off. Intel makes serious bank off Xeons and doesn't want to cannibalize those sales. If the 10-core Xeon is coming in at a higher price, that could funnel down to the i7-6950X.

Accidentally on purpose?
This is the Intel support site listing for the unannounced Core-17 6950X processor. It's since been pulled.

But then there's Zen

The real wild card in all this is AMD's Zen. This will be the company's first major CPU launch in years. Redesigned from the ground up and rumored to pack from two to 32 CPU cores, Zen is also adopting an Intel-like Hyper-Threading technology. It could pose the first true competition to Intel's high-end CPUs since the days of the Athlon FX-51.

Knowing full-well that Zen is arriving later this year, does Intel price its 10-core chip to crush AMD on pricing before it arrives, or just wait and see whether Zen poses a real threat? If Zen is priced to give consumers, say, a 16-core chip at $1,000 or $1,500, does Intel then gut the price of its Core i7-6950X? Who knows.

What we do know for sure today, thanks to ASRock, is that Broadwell-E will indeed have 10 cores. The chip is expected to launch at Computex in June. ⏻
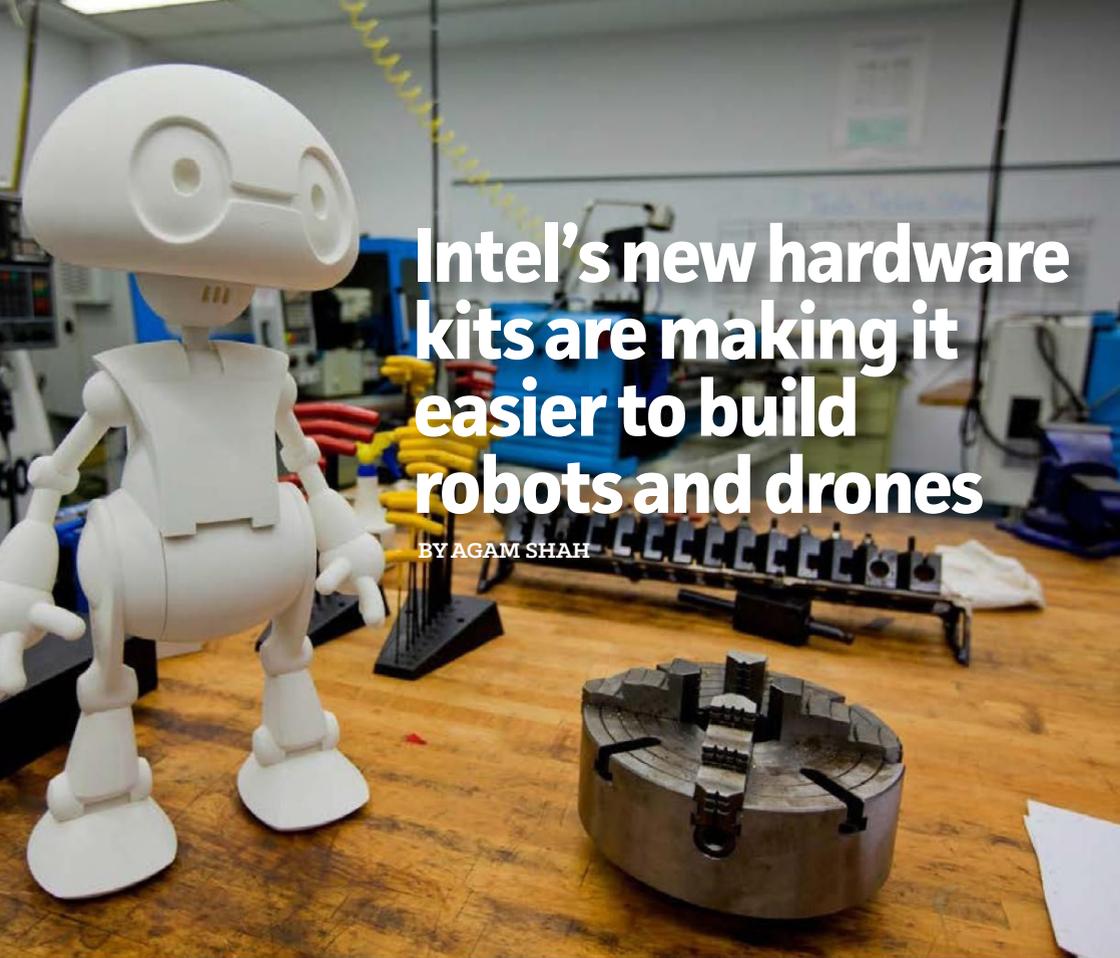
Intel's new hardware kits are making it easier to build robots and drones

BY AGAM SHAH

INTEL'S KEYNOTES CAN be fun, with robots parading on stage and drones zigzagging around the room. Now Intel's making new hardware to help enthusiasts join the fun by building robots and drones at home.

The Robotic Development Kit and Aero Kit (go.pcworld.com/intelroboticdevkit) provide the necessary hardware and software tools to build robots and drones, respectively. The kits were announced at the Intel Developer Forum in Shenzhen, China.

A major element of the developer boards is the RealSense 3D camera, which will ship with the kits and help the robots and drones navigate and avoid obstacles. The depth-sensing camera can recognize items and determine the size, shape, and contours of

Drone 100, Intel's coordinated flight of 100 Unmanned Aerial Vehicles (UAVs) also known as drones.

objects. For robots, the camera provides computer vision, which is analogous to eyes in humans.

The Robotic Development Kit is available for preorder now at $249.99, and it will ship sometime in June. It has a credit-card-size board from Aaeon, which is equipped with an Intel Atom x5 Z8350 CPU, an internal Intel HD 400 graphics processor, 4GB of DDR3 RAM and 32GB of storage. Other features include an HDMI slot, gigabit ethernet, two USB 2.0 ports, a USB 3.0 port, a camera interface and an eDP (embedded DisplayPort) slot to connect a display. It also has a 40-pin GPIO (general purpose input-output) slot to hook up add-on boards that may have sensors or other components.

The kit will ship with Ubuntu Linux but will also support Windows 10 and other versions of Windows.

The Aero Platform is a "ready-to-fly developer platform," an Intel spokesman said in an email. It has an Intel Atom x7-Z8700 processor, DDR3L RAM, and flash storage, and it will run a version of embedded Linux. Full details and price aren't yet available, but it will ship in the second half of this year.

The hardware is part of Intel's effort to diversify outside PCs into new areas. It's also an effort to provide do-it-yourselfers with the resources to develop a wide range of gadgets, appliances, and smart home and industrial equipment.

Robotics has become an important educational tool, and other companies are also paying attention. Amazon paid $775 million (go.pcworld.com/amazonbuyskivasystems) for industrial automation company Kiva Systems, and it wants to deliver products using drones. Google has also invested in robotics companies.

Nvidia's Jetson TX1 development board is already becoming popular for building drones and robots. The most software-friendly robotics and drone development board is Qualcomm's DragonBoard 410c, which supports Windows 10 IoT Core, embedded Linux and ROS (Robotics Operating System), the most widely used robotics OS.

Intel sells development board for as little as $15 to build wearables, electronics, and IoT devices. Those developer boards are mainly based on the company's Quark processors. ⏻

It's also an effort to provide do-it-yourselfers with the resources to develop a wide range of gadgets, appliances, and smart home and industrial equipment.

'EVE Online' players are solving real-world science problems: Meet Project Discovery

BY HAYDEN DINGMAN

"THIS IS PROBABLY the first time high-profile scientific journals are publishing screenshots from EVE Online," said Attila Szantner, cofounder of Massively Multiplayer Online Science (MMOS) (mmos. ch). "This is going to be the next big revolution in citizen science."

Szantner was standing on stage at EVE Fanfest 2016 talking about Project Discovery (eveonline.com/discovery), a minigame in *EVE Online* that's quite a bit more than it appears.

In-game, Project Discovery is a "classified research program" run by the Sisters of Eve to analyze samples of the Drifters, a mysterious and
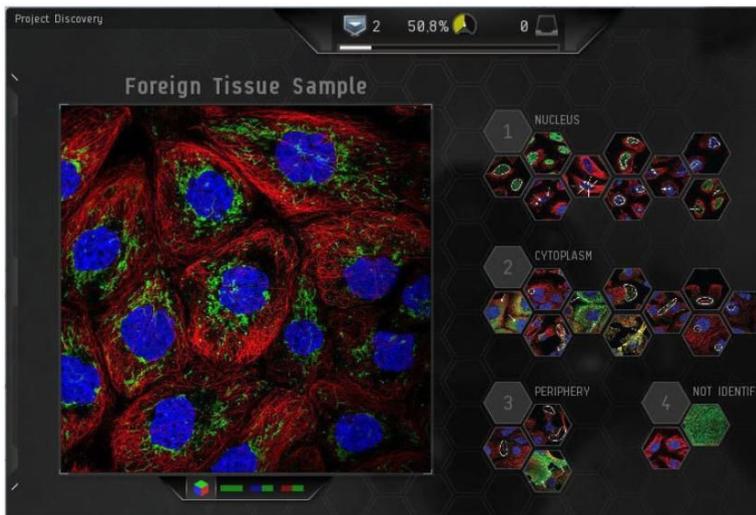
Protein mapping the Project Discovery interface in EVE Online.

threatening faction in New Eden lore. Players are told that these biological samples hold the key to Drifter technology.

That's in-game.

But out-of-game, Project Discovery is actually a joint partnership between EVE developer CCP, MMOS, and the Sweden-based Human Protein Atlas (HPA) (proteinatlas.org). The goal? To put *EVE Online* players to work classifying human proteins.

"Fifteen years ago the Human Genome Project was finished. Even though it was so long ago, we don't know what the proteins in our bodies do. That's what we're trying to figure out at the Human Protein Atlas," said HPA's Emma Lundberg, director of Subcellular Atlas.

And figuring out what human proteins *do* is often related to knowing where human proteins are *located*—mapping out where each protein is found in the body by way of cell imaging. "Since we have 20,000 genes and a lot of different cell types, that makes a lot of images," says Lundberg.

Which is where *EVE* comes in.

Citizen science—scientific contributions done by people who aren't

traditional scientists—has been around for a while, but one of the most notable examples in gaming is Foldit (fold.it/portal), which has players determine protein structures a through game-ified set of rules. The difference with Project Discovery is that it's not a standalone product. It's inside *EVE Online* itself.

Why? Because it keeps people participating. "The biggest challenge [with citizen science] is the long-term engagement of users," says Szantner. He and a partner founded MMOS a few years ago based on a simple idea: What if they could harness users from already-established games to do scientific work?

In-game rewards for participating in Project Discovery in EVE Online.

With Project Discovery, motivation takes the form of in-game *EVE Online* rewards. Users look at images of cells taken from the HPA database, classify the different elements of the cell, and then are graded on accuracy against both control images and other users. In return they're given ISK (*EVE*'s in-game currency) and experience, plus new titles and equipment.

And a month after launch, Project Discovery was looking like a massive success. In the first few hours, *EVE* players classified over 400 thousand cell elements. That number rose to 2.2 million after a week, and at Fanfest Szantner revealed that they're now sitting just shy of 8 million. Again, that was in *one month*.

To give you some perspective, Lundberg converted that into a time estimate. Players spent 18.2 million minutes classifying in one month, which equates to 34.7 *years*—or 163 working years, by what Lundberg called "Swedish measurements."

"[Project Discovery] is averaging out at about 150 thousand classifications [per day], which is higher than even our most optimistic predictions," said Szantner. "What we're doing is gaming history and

citizen science history as well."

EVE players have already crunched through the entirety of Project Discovery's first data set, and now MMOS is prepping to run the same data a second time to improve the strength of the conclusions.

But it works, and it's got scientists interested. By the end of the year, MMOS

is hoping to expand Project Discovery into other data sets, potentially giving players the option of helping with cancer, exoplanet, or even cosmic background radiation research.

Not that there haven't been some weird stumbles. "It didn't take long for you to realize how to game the game," Lundberg said with a laugh during her presentation. Soon after Project Discovery's launch, players realized rewards were given for consensus. The result? Everybody spammed "Cytoplasm" on every image, exploiting the system for rewards while totally ruining the data.

That's fixed though, with Project Discovery tweaking how consensus was reached and removing that exploit. Video games, man.

One day scientists may cure protein-centric hereditary diseases, though, and it's incredible to think *EVE Online* players will have helped in that process. Since launch, Project Discovery has helped identify 109 new protein candidates in what Lundberg called the Rods & Rings category. That's real scientific legwork, done by virtual space pilots. Pretty amazing. ⏻
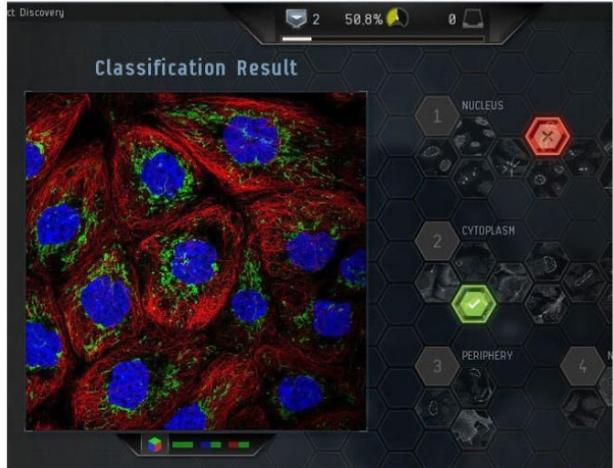
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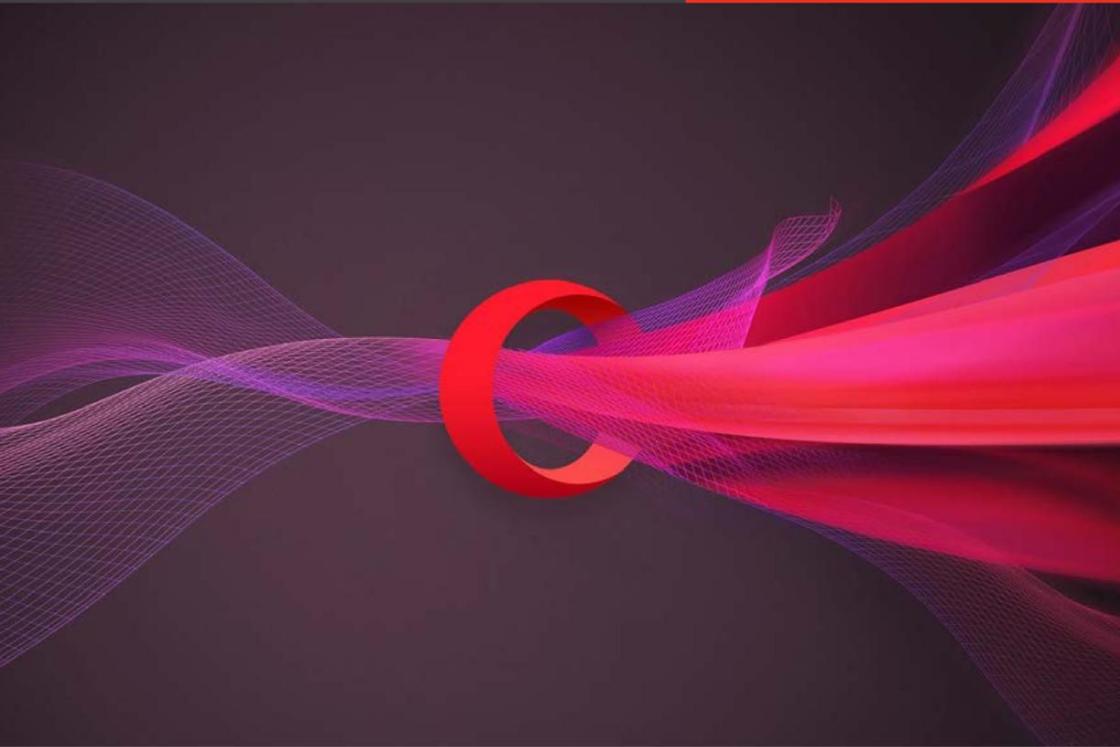
Opera releases the browser it's trained to kill ads in Android and Windows

Ad blocking is now officially mainstream.

BY LUCIAN CONSTANTIN

IN MARCH, OPERA added native ad blocking (go.pcworld.com/adlbockopera) to a developer edition of its browser. Now, the company has pushed that feature into general release, dramatically decreasing the load time of webpages at the expense of the advertising revenues that would normally be driven to the site.

Native ad blocking is available both as a browser for Windows PCs and the Opera Mini browser for Android. Blocking ads not only speeds up the overall browsing experience, according to Opera, but can also eliminate a significant chunk of data that must be downloaded by smartphone users to view a webpage.

An Opera spokesman said users could expect roughly the same performance from the stable version as they'd experienced in the developer build, with pages loading up to 90 percent faster than with ads enabled. Opera also went a step further, claiming that building native blocking into Opera made the browser about 45 percent faster than the stable version of Google's Chrome browser with AdBlock Plus (a third-party ad blocker) integrated.

"Our goal is to provide the fastest and the

The new version of the Opera browser will show you how many ads it found on the page.

Block ads ⚙

Ads are blocked on this site

41
On this site
That's a lot of blocked ads!

1624	2346	2346
Today	In last 7 days	In total

See how fast websites load!
Speed test: with and without ads
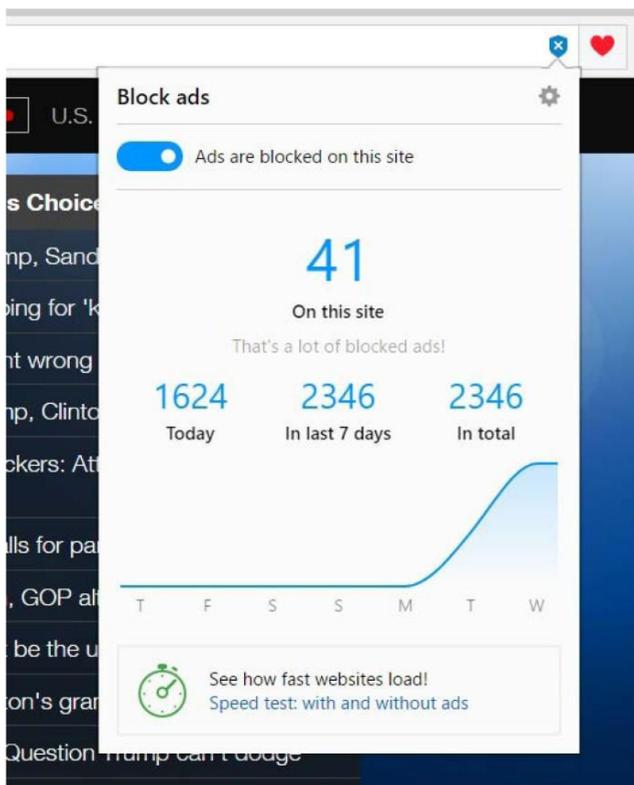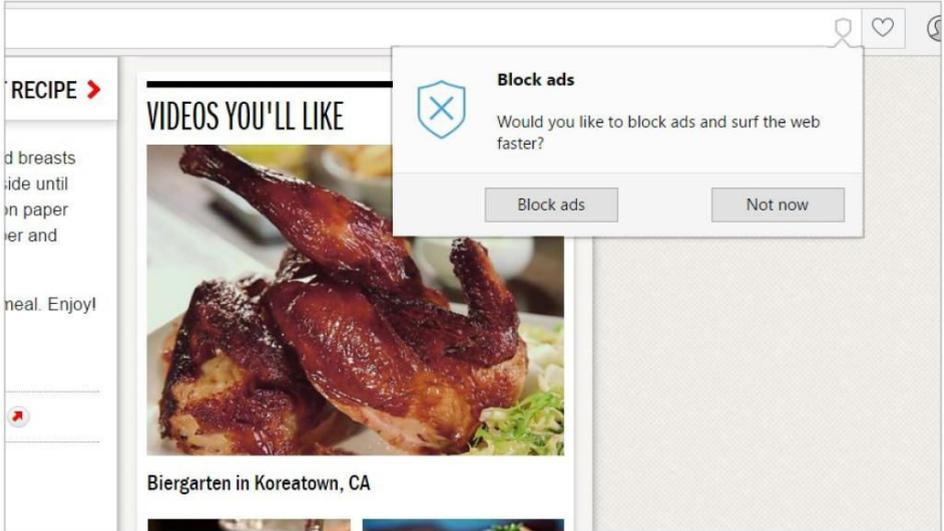
smoothest online experience for our users," Krystian Kolondra, the senior vice president in charge of engineering for Opera, said previously. "While working on that, we have discovered that a lot more time is spent on handling ads and trackers than we thought earlier."

Why this matters: In many ways, ad-blocking browsers like Opera represent the Napster of online journalism: a convenient, efficient way to load webpages unencumbered by the scripts, tracking pixels, and banner ads that can result in a bumpy experience. With the demise of print subscriptions, however, publishers will inevitably turn to other means of raising revenue—including preventing a webpage from being loaded if a user has an ad blocker enabled. It ain't over yet.

How to turn off ads in Opera

In Opera Mini for Android, ads can be turned off by tapping the O menu, then toggling ads either on or off. Opera said Opera Mini will allows ads to be blocked in both the high- and extreme-saving modes.

Likewise, ads can be turned off in the desktop version of Opera either from the Settings menu or from a pop-up that should appear

Opera's latest browser immediately encourages you to begin blocking ads.

when the first page is loaded. Whitelisting a site can be performed by clicking the shield icon, which turns ad blocking on or off. As in the developer build, you'll be able to see how many ads you've blocked per page, and even load the page with ads turned on and off in a side-by-side comparison.

In last year's tests, Opera delivered the fastest browsing experience, roughly equivalent to Google's Chrome.

The new build also adds two unrelated features that are worth checking out. The desktop version of Opera includes a video pop-out feature, which shunts a playing video to the side of your screen. Opera Mini also adds a feature to add webpages to your home screen, Opera said.

In last year's tests, Opera already delivered the fastest web browsing (go.pcworld.com/adlbockopera) experience available, roughly equivalent to Google's Chrome. Now, with ad blocking turned on, Opera could very well surge to the front of the pack. ⏻

How to stop ransomware: Backup can protect you, but only if you do it right

BY LINCOLN SPECTOR

MOST FORMS OF MALWARE hide their infections, but ransomware (go.pcworld.com/5ransomware) boldly declares itself and demands money or you'll never see your beloved files again. And if you haven't taken the right precautions ahead of time, your choices really are either pay the money or lose your files.

Your best defense is to block the malware before it can infect your PC. Use an antivirus program, keep it running whenever your PC is on, and keep it up-to-date. Don't click links or download files from

SoftGozar.com

suspicious emails—even if you think you know the person who sent it. Finally, be careful (go.pcworld.com/avoidmalware) about downloading and installing software.

If ransomware strikes, only a good backup can save your files, your money, and your dignity. Not every backup is good enough, though.

As the ransomware quietly encrypts your files, your backup program will likely back up the files in their newly encrypted, and therefore useless, versions. So you need a program that does versioning—saving older versions of your files. That's not too much of a problem. Most backup programs have this feature.

But even those older versions will be useless if the ransomware succeeds in encrypting all the files on your backup drive. That's one reason why I recommend keeping the external backup drive connected to the PC as little as possible. Once a day, plug it in, run your backup program of choice, and safely remove it.

If you back up in the background to a NAS, back up the NAS regularly.

> *If ransomware strikes, only a good backup can save your files, your money, and your dignity. Not every backup is good enough, though.*

Cloud-based backup is always on, but the files upload slowly. While that pace can be annoying, it adds an additional level of protection: It could be days, or even weeks, before all of the encrypted files get into the cloud.

Carbonite's (carbonite.com) Norman Guadagno told me that the cloud-based backup service "has been getting 500 calls a month" from customers hit by ransomware. "We help them identify a clean backup image and help them to wipe and reinstall." I assume that Carbonite's competitors do the same.

Not that this is perfect. Your most recent work will likely be lost.

Will the ransomware authors find way to destroy cloud-based backups? Guadagno admitted, "I worry about that all the time."

For the time being, cloud-based backups—and local ones where the backup drive is usually not plugged in—are safe. Hopefully it will stay that way. ⏻

Phone hackers for hire: A peek into the discreet, lucrative business tapped by the FBI

BY JONATHAN KEANE

WHEN THE FBI paid someone to crack the San Bernardino shooter's iPhone, it didn't just deftly bypass Apple's objections. It also made the public aware of the business side of hacking—a business that is apparently as lucrative as it is discreet. "The recent argument between Apple and the FBI over unlocking an iPhone has likely revealed to the public for the first time that companies who specialize in cracking mobile devices even exist," said Bill Anderson, chief product officer at OptioLabs (optiolabs.com), a mobile-security developer.

Everything we learn about the FBI's hackers makes the situation more intriguing. Initial reports indicated the feds were using the

services of Israeli mobile forensics firm Cellebrite to crack open Syed Rizwan Farook's iPhone. Since then, a *Washington Post* report claimed the FBI hired independent professional hackers, who used a zero-day exploit (a vulnerability unknown to Apple). Another April report showed that the FBI is now willing to help local law enforcement agencies around the country crack iPhones they have in evidence.

Though the FBI has remained mum on any specifics, a recent remark by FBI Director James Comey suggested the fee for the hack was well over a million dollars. Most recently, the FBI declined to divulge details to another government program (the Vulnerabilities Equities Process), claiming ignorance of how the hack actually worked.

Cellebrite, or whoever it may be, is just one company that can attempt to unlock a phone in law enforcement's possession, but now we—and profit-minded hackers—also know how profitable this business can be, pointed out Shane McGee, chief privacy officer at cyber-security firm FireEye. "That publicity is like a beacon to vulnerability researchers and security experts that would otherwise show little interest in hacking iOS," he told me.

Beyond one phone

Farook was using an iPhone 5c, so there could be other vulnerabilities in this phone and others that have yet to be found—and possibly monetized. "While most researchers that discover vulnerabilities practice responsible disclosure and communicate those vulnerabilities to Apple so they can be patched," McGee added, "I'm sure we'll also see some trying to sell their exploits to the highest bidder, including the Department of Justice."

Forensic scientist and iOS security expert Jonathan Zdziarski told me

he believes it will be business as usual for mobile forensics startups, but the veil has been lifted somewhat.

"I believe the only thing this case has done is it's made the public more aware of what goes on daily," added Lewis Daniels from Secure Any Mobile, on the business of breaking encryption. "This of course will make the hacking community more attractive," he said, "as working with the authorities to do what they have the passion for doing is a great opportunity and legal."

Braden Perry, a Kansas City attorney specializing in regulatory and governmental matters, told me the Apple-FBI case could encourage security companies to help authorities and compete for what he called "lucrative contracts." Perry noted that these companies would have to adhere to strict guidelines in their business relationships, but where this could get muddy is in places outside of the United States' jurisdiction. This could open up a new avenue for individuals and companies to try to unlock phones for what Perry called "more sinister purposes."

That said, there was a mixed view among many of the people I spoke with over whether law enforcement agencies will now seek out external companies' help rather than serve notice to an OS maker, like Apple.

"In the end, the public announcement that iPhones can be unlocked through an outside party empowers others to attempt the same," he said.

That said, there was a mixed view among many of the people I spoke with over whether law enforcement agencies will now seek out external companies' help rather than serve notice to an OS maker, like Apple.

Dr. Yehuda Lindell, of Israeli encryption startup Dyadic Security, suggested the FBI might decide to streamline the process by hiring its own hackers. "It would make more sense to me that the way law enforcement respond to this is to develop in-house expertise to do it themselves," Lindell said. "I can't see them always going to an external company."

Making an exception

There's another side to the encryption debate, where people want to access a phone for more sentimental reasons. An Italian man wrote a public letter to Apple in March asking the company to circumvent the encryption on his deceased son's iPhone to retrieve photographs stored on the device. "Don't deny me the memories of my son," he wrote. Much like some of the families of victims in Farook's crimes, he may be struggling to understand why an exception can't be made in such heartbreaking circumstances.

> An Italian man wrote a public letter to Apple in March asking the company to circumvent the encryption on his deceased son's iPhone to retrieve photographs stored on the device.

Mark Grabowski, communications professor at Adelphi University in New York, points out that phone-cracking services have always been available on the Deep Web. "Despite all the publicity the FBI's hacking of the iPhone has brought, that's where they will likely remain since it is a crime to hack into someone else's phone," Grabowski said.

The very nature of phone hacking means that even legitimate professionals have good reason to maintain a low profile. "While the U.S. government wants companies to help them hack into others' phones, I don't think they want these tricks shared with others," Grabowski explained. "So, I don't expect companies to be openly advertising these services anytime soon—at least not to hack into third-party cell phones—unless it's an 'ethical hacking' service where they're hired to test their own client's cell phone security."

Make sure you know where to find your family in an emergency

Ad Council | Ready ✓ | FEMA
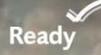
START YOUR PLAN AT READY.GOV

MOM

ALICE

ALEX

DAD
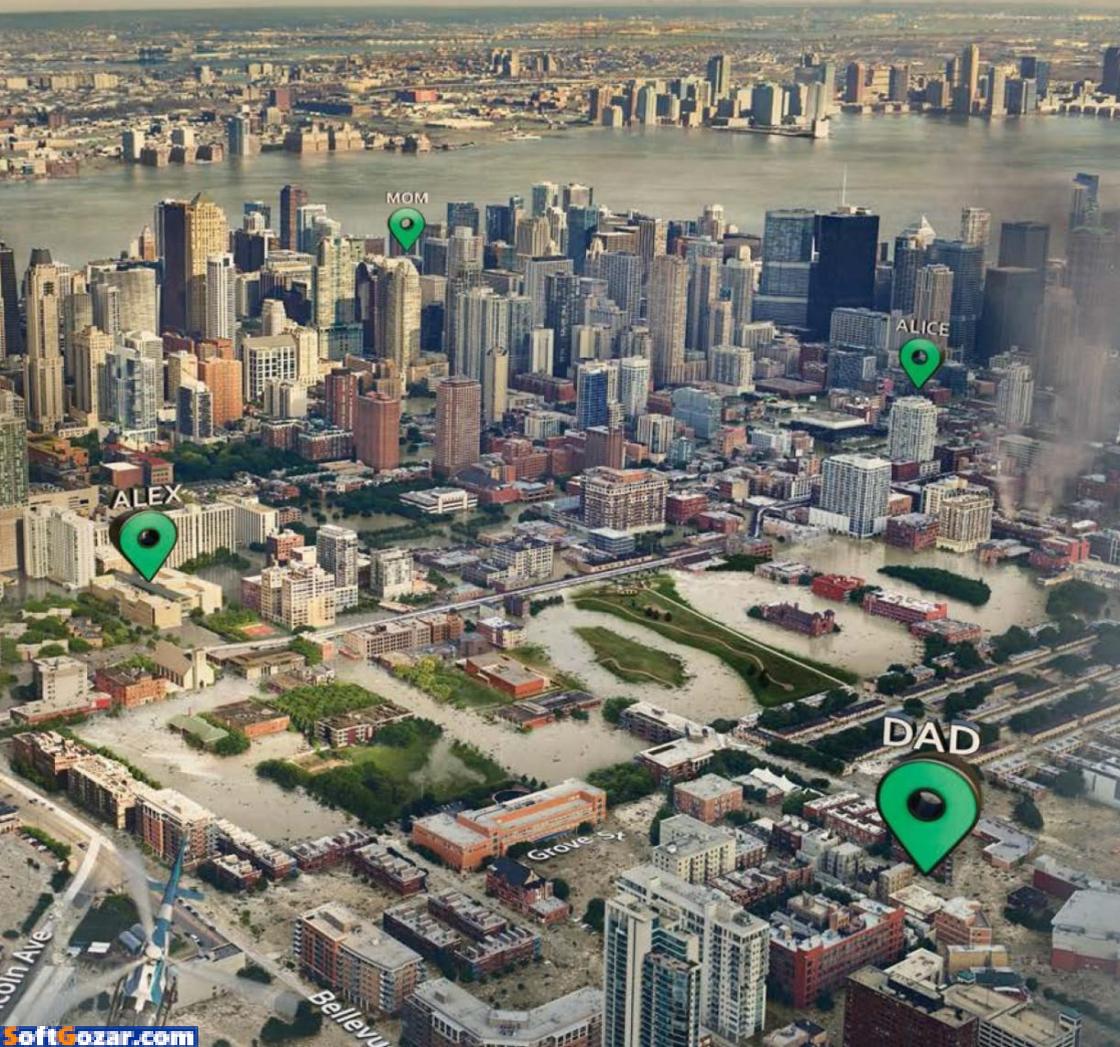
REVIEWS & RATINGS

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TESTED IN PCWORLD LABS
In this section, hardware & software
go through rigorous testing.

REVIEWS & RATINGS

MacBook 2016: Ultraportable laptop satisfies with speed gains

BY ROMAN LOYOLA

WHEN IT COMES TO hardware, Apple isn't afraid to force its users to adapt, to change habits. Longtime Mac users remember when Apple stopped including floppy and optical drives, or when FireWire was discontinued. More recently, Mac users have had to accept the inability to upgrade hard drives and RAM, or that the Magic Trackpad 2 (go.pcworld.com/magictrackpad2) is the preferred input device, with its support for gestures that can't be performed on a Magic Mouse 2 (go.pcworld.com/magicmouse2).

The MacBook,available in the Apple Store (go.pcworld.com/macbook), is one of those game changers. When it was released last year (go.pcworld.com/12inchmacbook), it was pretty obvious that Apple wanted to push its users in a certain direction, to a place where there are no wires, where you depend on the cloud, where you can carry a laptop effortlessly and never worry about the battery running out.

The push was more like a big shove. Apple's thinnest and lightest laptop has only one port for connecting devices, and it sports a processor that sacrifices performance. And Mac users pushed back,

Watch the video at go.pcworld. com/2016 mbookvid

especially about the single port. It wasn't hard to find someone who wished that the MacBook was more like the MacBook Pro (go.pcworld. com/shopmacbookpro) or that Apple would do something with the MacBook Air (go.pcworld.com/macbookairshop). (Apple did do something with the MacBook Air, the 13-inch model specifically. It now comes standard with 8GB of memory instead of 4GB.)

When Apple announced (go.pcworld.com/ rosegoldmacbook) that it was updating the MacBook, Mac fans clicked on news links in anticipation. Will Apple add another port? Or maybe upgrade from USB-C to Thunderbolt 3 (go.pcworld.com/thunderbolt3)? How 'bout an HD FaceTime camera instead of the 480p camera that was on last year's MacBook?

Nope, sorry. None of those features were added. But Apple did upgrade the processors and graphics. That's certainly nothing to scoff at. In fact, the MacBook closes the gaps between itself, the MacBook Pro, and the MacBook Air, so much so that for general use, the speed should satisfy most users.

The MacBook also has longer battery life. Apple's battery specification is now an hour longer than the previous MacBook; 10 hours for "wireless web" and 11 hours for "iTunes movie playback." Apple told me that the longer battery life is due to better battery chemistry. The size of the battery is the same as before.

And, oh yeah, the MacBook is available in Rose Gold now, in addition to Gold, Silver, and Space Gray. You won't find those color options with the current MacBook Pro and MacBook Air, for what it's worth.

A better performer

Everything on the outside of the MacBook is the same as before, so I won't dive into my thoughts on things

Apple MacBook (2016)

AT A GLANCE

The MacBook is for the user who values portability over anything else. The 2016 edition comes with a welcomed speed boost and a Rose Gold option.

PROS

· Small size and light weight make it ideal for travel

· Increased performance

· Improved battery life

CONS

· Only one USB-C port for charging and peripherals

· Reduced key travel on keyboard makes the keys uncomfortable to press

· 480p FaceTime camera

· No flash storage customization options available

$1,299 and $1,599

★★★★★

like its size, weight, and construction; the 12-inch, 2304 x 1440 Retina display; the Force Trackpad; or the keyboard. For more details about these parts, see our review of the 2015 MacBook (go.pcworld. com/12inchmac book) by Jason Snell (sixcolors.com). His thoughts still hold up and jibe with my thoughts, though maybe I dislike the keyboard more.

The major changes are internal, so let's focus on those. The MacBook now has Intel Skylake (go.pcworld.com/skylakecorem) processors, an upgrade from the Broadwell processors used when the MacBook was introduced last year. Apple uses the Core M (go.pcworld.com/intel corem) version of Intel's processors in the MacBook, which are designed for mobile devices.

Apple offers two standard configurations: the $1,299 MacBook features a 1.1GHz dual-core Core m3 processor with Turbo Boost up to 2.2GHz, and the $1,599 MacBook has a 1.2GHz dual-core Core m5 processor with Turbo Boost up to 2.7GHz. (Both models have 4MB L3 cache and 8GB of 1866MHz LPDDR3 RAM.) For an additional fee, you can upgrade the processor to a 1.3GHz dual-core Core m7 processor with Turbo Boost up to 3.1GHz. (This review focuses on the $1,599 MacBook.)

How much of a speed improvement does the 2016 MacBook offer

Apple didn't change anything on the exterior of the newest edition of the MacBook. It has the same screen, keyboard, and trackpad found in the 2015 version.

47
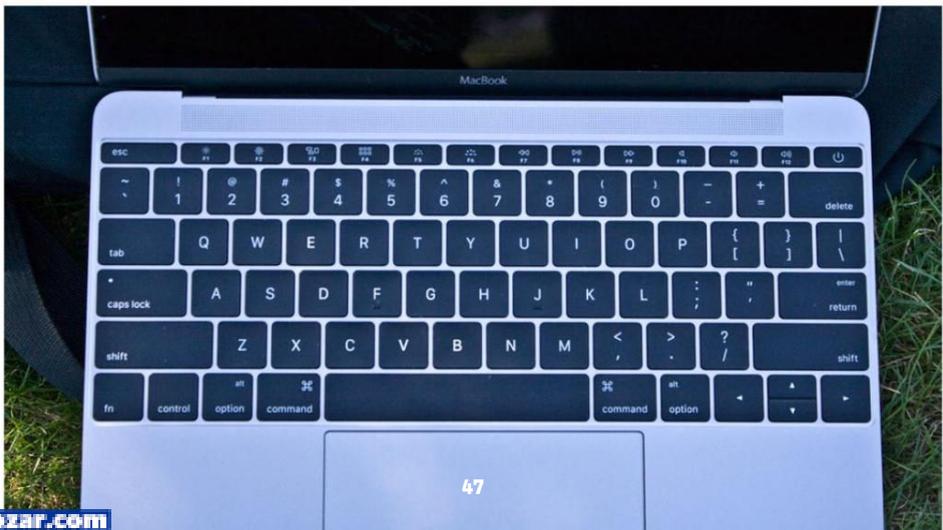
64-Bit Geekbench 3: 2015 vs. 2016 MacBooks

MacBook	Single-core	Multi-core
MacBook (2016) 1.2GHz dual-core Core m5 (Skylake)	2927	5875
MacBook (2015) 1.3GHz dual-core Core M (Broadwell)	2637	5276
MacBook (2015) 1.2GHz dual-core Core M (Broadwell)	2437	5049
MacBook (2015) 1.1GHz dual-core Core M (Broadwell)	2299	4489

■ Geekbench 3 Single-core (score)　■ Geekbench 3 Multi-core (score)
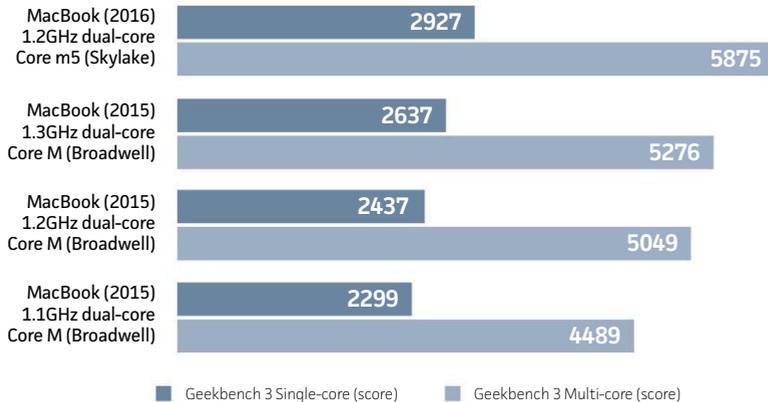
LONGER BARS/HIGHER SCORES ARE BETTER

on last year's version (go.pcworld.com/macbook2015)? Using Geekbench 3 (primatelabs.com/geekbench), the 1.2GHz Core m5 offers an increase ranging from 11 to 30 percent, depending on the older processor that it is being compared to. For example, in Geekbench's 64-bit multi-core test, the 1.2GHz Core m5 is 11 percent faster than the 1.3GHz dual-core Core M processor that was an upgrade option for the 2015 MacBook. Another example: In the same test, the 1.2GHz Core m5 is 30 percent faster than the 2015 MacBook's 1.1GHz Core M processor. Generally speaking, the speed increase isn't unusual; we've seen similar increases in past Mac laptop upgrades. Faster is always better.

64-bit Geekbench 3 results: 2016 and 2015 MacBook

Now let's compare the performance to the MacBook Air. Last year's MacBook was about 9 percent slower than the current 1.6GHz MacBook Air (which was released in March of 2015 with a Broadwell processor). That speed difference threw a wrench into a shopper's decision making: Pay

$1,199 for a faster 13-inch MacBook Air or spend $1,299 or $1,599 for a slower MacBook? (Sure, there are other differences to consider, like the display and ports, but I'm simplifying here for argument's sake.)

Fortunately, with the new MacBook, you feel like you're getting performance that better justifies the price difference. The 1.2GHz Core m5 MacBook is 12 percent faster than the 1.6GHz MacBook Air in Geekbench's single-core test; that's a nice boost compared to last year, where the 2015 MacBook was as fast or slower (depending on which processor you pick) than the MacBook Air. In Geekbench's multi-core test, the new MacBook was just 1 percent faster than the MacBook Air. But to put that in perspective, last year's MacBook was slower than the MacBook Air by a range of 9 to 20 percent.

For reference, I also compared the 1.2GHz Core m5 MacBook to the current 13-inch MacBook Pro models, which have Broadwell processors. Interestingly, the MacBook isn't far behind in Geekbench's single-core test. That means that for tasks like email, writing apps, spreadsheets, and basic websites, you may not notice a speed difference between the two different laptops. But as expected, the MacBook Pro blows past the MacBook in Geekbench's multi-core test. Translation: With apps that can use multiple processing cores, like professional video, audio, or image editors, you're better off with a

The MacBook's USB-C port is for charging and connecting peripherals. If you want more ports, you either need to connect a USB-C hub, or consider a MacBook Air or MacBook Pro.

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MacBook Pro.

One last platform comparison: How does the new MacBook stack up against the iPad Pro from a pure performance standpoint? You might be surprised. Both the 12.9-inch and 9.7-inch iPad Pro perform in line with the new MacBook. Just another thing to consider (or to make your decision more complicated).

Port of contention

Of course, there's more than performance to consider when picking a Mac laptop. As I mentioned earlier, much of what the MacBook offers hasn't changed from last year and was covered in our previous review. But the single USB-C port is a serious point of contention for shoppers, so I feel I should address it.

Apple positions the MacBook as the laptop for the wireless world, with "wireless" meaning more than just your Internet connection. It also applies to external input devices (there's Bluetooth for that) and external storage (the cloud). (There is an audio-out jack on the opposite side of the MacBook, so you can still use wired headphones and speakers.) You shouldn't really need to use the USB-C port, except when you need to charge the laptop.

You shouldn't really need to use the USB-C port, except when you need to charge the laptop.

Why didn't Apple upgrade the port to Thunderbolt 3 (go.pcworld.com/thunderbolt3usbc), which uses the same port type and is compatible with USB-C? When I posed this question to Apple, a representative said that Thunderbolt 3 has chip and thermal considerations that don't fit with the MacBook's fanless design. It's not as simple as slipping in a Thunderbolt subsystem in place of USB-C, so if Thunderbolt 3 ever does make it to the MacBook (if it's possible), it's going to take some re-engineering of the internals.

The MacBook's single USB-C port is a deal-breaker for some. You'll have to go with a MacBook Air or a MacBook Pro. But you really want the size and weight of the MacBook, you say? You could wait another year and see if Apple finally relents and adds another port. It's not

64-Bit Geekbench 3: MacBook vs. iPad Pro

	Single-core	Multi-core
MacBook (2016) 1.2GHz dual-core Core m5 (Skylake)	2927	5875
12.9" iPad Pro A9X	3216	5473
9.7" iPad Pro A9X	3030	5179

■ Geekbench 3 Single-core (score)　　■ Geekbench 3 Multi-core (score)
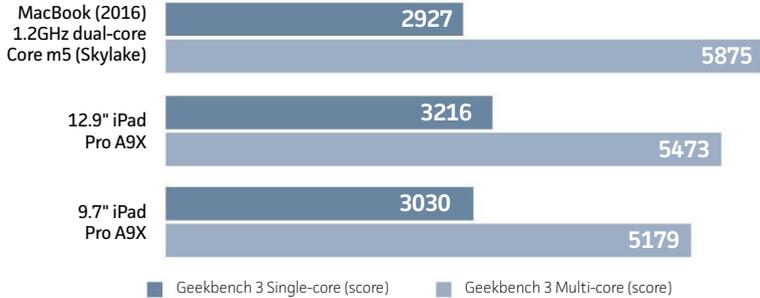
LONGER BARS/HIGHER SCORES ARE BETTER.

unprecedented. The first MacBook Air in 2008 had only one USB port, and then Apple added a second USB port two years later.

Another option is to wait and see what Apple does with the MacBook Pro. Apple's Worldwide Developers Conference (go.pcworld.com/wwdc2016) is in June, and the current MacBook Pro is a year old. Seems like the time is right for a MacBook Pro update between now and WWDC. The rumors (go.pcworld.com/macrumors201603) say that Apple is working on "ultra-thin" 13- and 15-inch MacBooks, so if you're waiting for a MacBook Pro, you need to hold on for a few more weeks.

What about the MacBook Air? I think some people still think of the MacBook Air as the ultra-portable laptop; after all, that's how it was positioned when it was released. Longtime users even remember the previous MacBook line, which was positioned as the affordable laptop. But the MacBook is now the ultra-portable. The MacBook Air is Apple's affordable laptop, à la the Mac mini. And I wouldn't be surprised if it was treated like the Mac mini, with an update cycle that's much longer than other Macs.

The iPad Pro option

Maybe one of the reasons why some don't understand the purpose of the MacBook is because the MacBook is being considered from a laptop user's

point of view. But if you think about it from an iPad user's point of view, the MacBook starts to make more sense. iPad users are used to not having to connect devices to their tablet and relying on wireless connections, so having one port on a laptop isn't that big of a deal.

Now, I get that the notion of iPad-first may not seem practical, but I don't think it's unrealistic. Kids are using iPads in school, and people do use smartphones and tablets as a primary computing device.

If available ports are not an issue, then the iPad Pro could be an option over the MacBook. The 12.9-inch iPad Pro weighs 1.57 pounds, and with a keyboard case, you approach 2 pounds. So when it comes to weight, there's not really an advantage. There is one with the smaller iPad Pro; even with a keyboard case, the 0.96-pound 9.7-inch iPad Pro will have a cumulative weight under 2 pounds, though you end up with a smaller screen.

64-bit Geekbench 3 results: 2016 MacBook and iPad Pro

In Geekbench testing, the iPad Pro doesn't disappoint against the MacBook. So what it comes down to is iOS versus OS X and the apps. Can you do what you need to do within iOS? That requires a close examination of the software you use and the tasks you perform.

Bottom line

For a lot of people, the MacBook is the ideal laptop. It's light. It's small. It's easy to carry. And it offers good performance for productivity software, though it can handle pro apps fine (you'll just have to wait a little longer for some tasks). The MacBook is meant to serve the user who is constantly on the go, and it serves its purpose well.

But if what you want is the MacBook Pro feature set in a MacBook body, then you'll need to either wait and see what Apple does in the near future or bite the bullet and buy a MacBook Pro. However, if you want more ports but you want them at an affordable price, then the MacBook Air is the laptop for you and you'll have to accept its compromises. ⏻

The MacBook Air is Apple's affordable laptop, à la the Mac mini.

Origin PC Chronos: Fast things come in small, loud packages

BY GORDON MAH UNG

IF YOU STILL THINK a gaming rig is a PC that's so big, you have to throw a party to get help lifting it out of the box, we've got news: Performance PCs don't have to be gigantic anymore.

Nothing illustrates that fact more than Origin PC's redesigned Chronos (go.pcworld.com/originchronos16) micro-tower, which packs state-of-the-art hardware into a machine not much bigger than last-generation gaming consoles. Sure, you'll choke at the price—$4,865 as configured—but the performance you get from such a compact machine is impressive.

Custom case

Most boutique vendors use off-the-shelf designs or slightly modified cases, but for this generation, Origin designed the Chronos from scratch and had it built to spec.

I've seen smaller micro-towers, but not many that are as friendly to wrench on. You're just a few screws away from accessing the RAM and CPU cooler, and even removing the GPU. Overall accessibility is quite good for a PC this small.

A lot of micro-towers are intended to be used vertically, but Origin gives you a choice. Want it horizontal? Just relocate the magnetized feet and lay it flat. The prototype case we saw at CES allowed you to rotate the logo too, but our test unit's logo wouldn't budge.

What's inside

Powering the Chronos are an 8-core Core i7-5960X and 16GB of 2666MHz DDR4 RAM in an Asrock motherboard. The RAM is in dual-channel mode, which is the only option in a board this small. That may scare off some people, but my own testing (go. pcworld.com/dualchannelram) indicates the performance hit is minimal in most tasks.

Gaming chores are left to Nvidia's top-dog Titan X graphics card, which may sound like an odd choice given the option of Nvidia's GTX 980 Ti. The 980 Ti is almost as fast and a lot cheaper, but for some reason, PC vendors have taken the VR craze as an opportunity to push the Titan X instead.

Origin has overclocked both the CPU and GPU in the Chronos. The 5960X is liquid-cooled, and it's been boosted to a range of 3.7GHz to 4.4GHz (its stock range is 3.0GHz to 3.5GHz). The EVGA GPU is air-cooled with a stock cooler, but still gets a bump of 195MHz to the GPU core and RAM. This should all add up to a stiff performance increase, and for the most part, that's true.

For storage, the Chronos comes with a 512GB Samsung M.2 850 Evo NVMe SSD and 5TB Western

Handbrake 0.9.9 (sec)

Origin PC Chronos (Core i7-5960x / Titan X)	1,266
CyberPower Trinity Xtreme (Core i7-5820K / Titan X)	1,505
Velocity Micro Z70 (Core i7-6700K / GTX 970)	2,750
PCWorld Zero Point (Core i7-4770K / GTX 980)	3,059

0   500   1000   1500   2000   2500   3000   3500

SHORTER BARS INDICATE BETTER PERFORMANCE
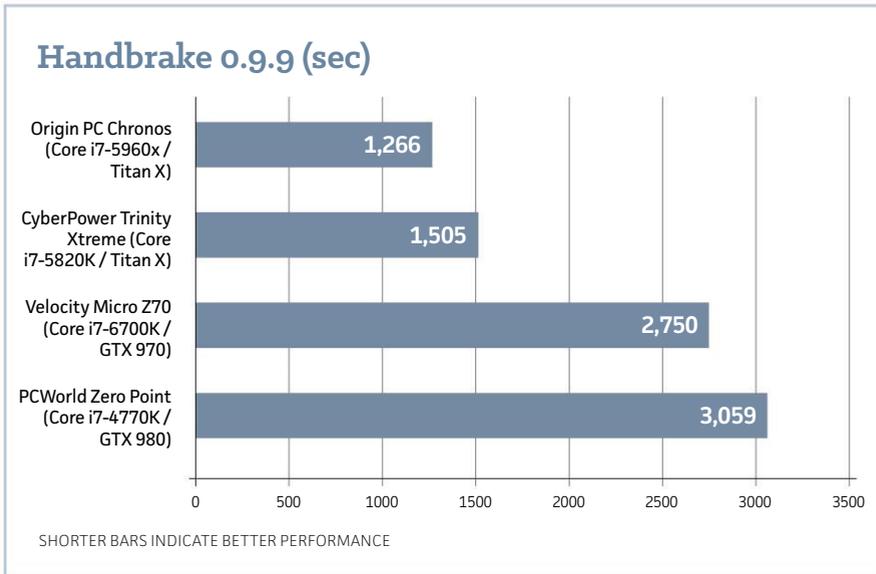
The 8-core and 6-core blow away the quad-core chips, but the small gap in performance between the Trinity Xtreme and Chronos is disappointing.

Digital Red hard-disk drive. The PCIe-based NVME drive is no slouch, with Crystal Disk Mark 4.0.3 measuring sequential read speeds in the 2.5GBps range and sequential write speeds in the 600MBps range.

You also get a slim slot-fed Blu-ray burner combo drive, and a 600-watt PSU provides plenty of juice for all this hardware.

Encoding Performance

Because you shouldn't buy an 8-core PC and then leave those cores unused, our first test was encoding a 1080p MKV file using Handbrake 0.9.9. This popular free encoder loves CPU cores—the results speak for themselves when you compare the Chronos with the quad-core processors in our zero-point desktop system and Velocity Micro's Skylake-based Z40 (go.pcworld.com/z40). The Haswell-E systems eat the quad-cores alive, but I'm a little let down by the scores from the

Chronos when stacked up against the CyberPower Trinity Xtreme (go. pcworld.com/trinityxtremepc). The Trinity Xtreme also uses a Haswell-E chip, but it has 6 cores instead of 8.

3DMark Performance

Most people buying the Chronos will have the intention of playing games, so we tested this little tower's gaming performance using the synthetic but well-respected 3DMark benchmark. As expected, the GeForce GTX 980 and the GeForce GTX 970 get left in the dust. The overclocked GeForce Titan X outpaces the stock-clocked card in the CyberPower Trinity Xtreme, too.

Tomb Raider Performance

We also gave a real game a go, and ran *Tomb Raider* at 2560x1600

Despite its size, working inside the Chronos isn't as bad as with other designs. Storage is kept behind the GPU, which means it may get a little warm.

They're just magnets, but the removable feet work relatively well and can be moved depending on the orientation of the case.

3DMark Fire Strike Extreme Overall

System	Score
Origin PC Chronos (Core i7-5960x / Titan X)	9,101
CyberPower Trinity Xtreme (Core i7-5820K / Titan X)	8,261
Velocity Micro Z70 (Core i7-6700K / GTX 970)	5,364
PCWorld Zero Point (Core i7-4770K / GTX 980)	5,525
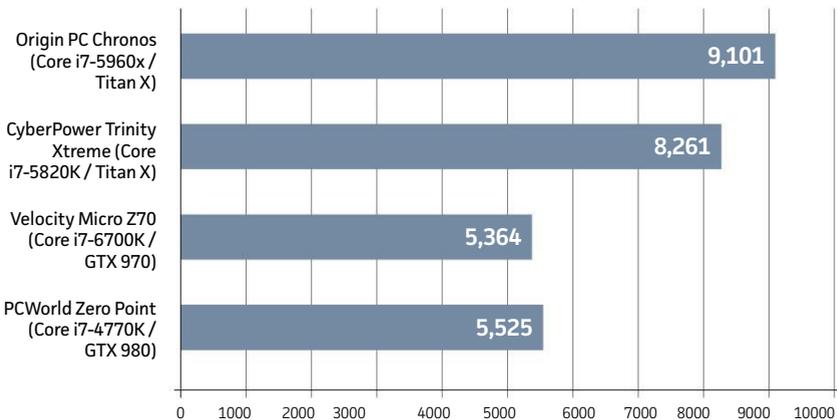
LONGER BARS INDICATE BETTER PERFORMANCE

Titan X is indeed faster than GeForce GTX 980.

resolution with the Ultimate preset to see how the Chronos stacks up. *Tomb Raider* is actually a little more sensitive to CPU clock speeds, so the faster chip in the Chronos outpaces the Trinity Xtreme by a healthy clip.

To find out how the single Titan X handles a more modern game, I ran *Middle-earth: Shadow of Mordor* at 4K Ultra HD resolution and set to Ultra with the 4K texture pack. I also threw in the results from a Falcon Northwest machine with three Titan X cards and a Maingear PC with four Titan X cards inside, to give you an idea of how the micro-tower Chronos compares to beefier systems,

You can see the classic dilemma with GPU scaling illustrated here, as you don't triple (nor quadruple) performance in *Middle-earth*. Still, you can clearly see that both the three-card and four-card systems are faster.

I also ran the machine at 4K resolution in *Rise of the Tomb Raider*, *The Division*, and *Rainbow Six Siege* using Very High for *Rise* and Ultra for the latter two games. *Rise of the Tomb Raider* and *The Division* had frame rates in the low to mid-40s, while *Rainbow Six* was in the 60s.

The upshot is the Chronos has enough chutzpah for some games at 4K, but others will require turning down settings to hit the magical 60fps mark. That's not bad for a single-GPU machine as small as an Xbox 360.

It's loud

If there's one thing you should take away from the performance numbers you've seen, it's that the Chronos is a fast machine. It crushes

When turned on, the Titan X gets a red LED treatment. Too bad that's AMD's color amirite?

Tomb Raider Ultimate 25x16 (fps)

Origin PC Chronos (Core i7-5960x / Titan X)	103.4
CyberPower Trinity Xtreme (Core i7-5820K / Titan X)	87.3
Velocity Micro Z70 (Core i7-6700K / GTX 970)	58.7
PCWorld Zero Point (Core i7-4770K / GTX 980)	55.1
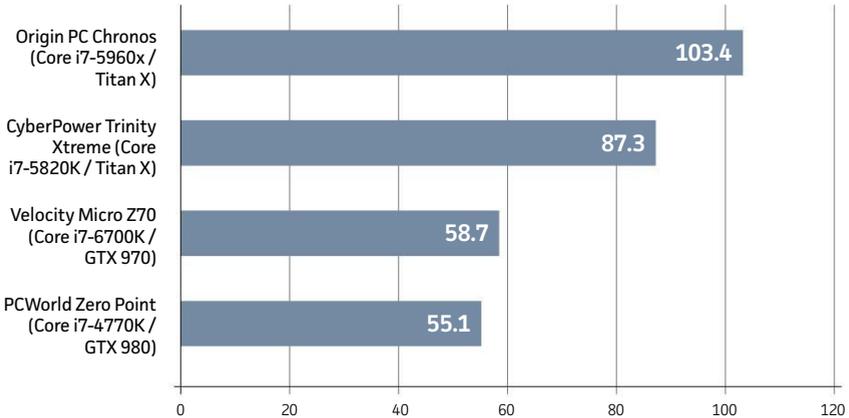
LONGER BARS INDICATE BETTER PERFORMANCE

Middle-earth: Shadow of Mordor 4K Ultra (sec)

Origin PC Chronos (Core i7-5960x / Titan X)	56.8
Main Gear Force X99 (Core i7-5960x / 4x Titan X)	101.5
Falcon Northwest Mach V (Core i7-5960X / 3x Titan X)	81.6
PCWorld Zero Point (Core i7-4770K / GTX 980)	34.2
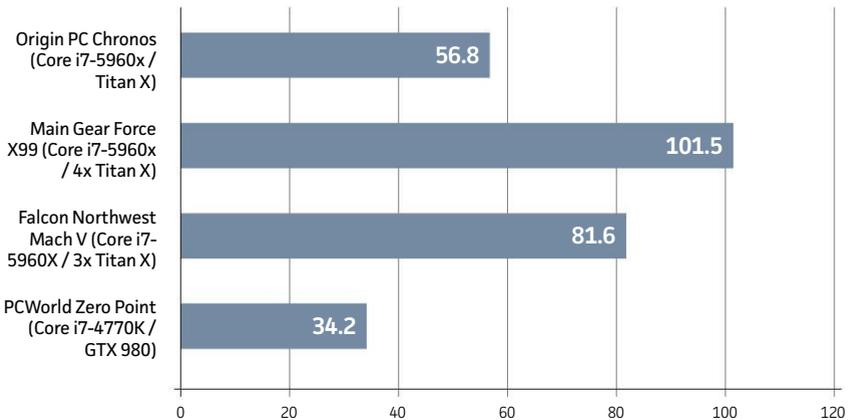
LONGER BARS INDICATE BETTER PERFORMANCE

Micro-towers can do everything a full tower can do—except run multiple video cards.

SoftGozar.com

quad-core machines in the CPU-heavy tasks such as video encoding, and its overclocked GeForce GTX Titan X also outpaces other single-Titan X machines we've seen.

   The problem is that performance ain't free. When you load up the Chronos with a compute- or graphically-intense task, the fans kick in—enthusiastically. The noise isn't server-fan shrill, but it's noticeably loud. You won't want it on your desk without a headset on and the volume cranked.

Conclusion

There are bigger reasons than fan noise to give gamers pause about the Chronos: If the rumors, leaked pictures, and parts on eBay are right, we'll be seeing fresh hardware from Intel, Nvidia, and AMD within months. It might be wiser to wait and see what comes down the pipeline, especially since those new parts should work just fine in the Chronos's existing design.

With a SteamVR Performance score of 11, the Chronos and its Titan X will be ready for VR gaming from day one.

The Chronos isn't much larger than the Xbox 360 and PlayStation 3.

Still, I like what I see. The Chronos is fast and compact, and it features a lot of clever touches like the magnetic feet and serviceable interior. Yeah, its price is difficult to swallow at nearly $5,000—hell, the paint job adds nearly $500 to the price tag, and with a $1,000 CPU and a $1,000 GPU, those extras all add up quickly. The good news is that at least you get the performance you're paying for. ⏻

IDG.tv

SanDisk Extreme 900 SSD: 10Gbps USB 3.1 performance at last!

BY JON L. JACOBI

AFTER TESTING SANDISK'S new Extreme 900 portable SSD, I just have one question for the rest of the industry: What's taking so darn long? We've waited seemingly forever for 10Gbps USB 3.1 devices to arrive, and the Extreme 900's 800MBps performance has us wanting more.

Specs and pricing

Unlike Samsung's pint-sized T1/T3 (go.pcworld.com/samsungt3rev), the Extreme 900 is roughly the dimensions of a typical external 2.5-inch hard-disk drive. It's somewhat chunky and heavy at that, though quite handsome. You'll be able to slide it into larger pockets.

Two reasons for the Extreme 900's size are heat dissipation and shock resistance. A bigger cause is SanDisk's use of two TLC (Triple Level Cell/3-bit) NAND-based, 6Gbps SATA SSDs inside. Squeezed in with them are the controller and bridge chip required for running them in RAID 0—the only way to leverage 6Gbps SATA into 10Gbps performance. After SATA RAID, the next performance step would be PCIe SSDs and a multi-lane PCIe-to-USB bridge chip.

The Extreme 900 features a USB Type C port and ships with both Type C-to-Type C, and Type C-to-Type A SuperSpeed cables. It's a nice inclusion, but it's not as great as it could be: Not every USB-C device you plug this storage drive into will support 10Gbps USB 3.1. Right now, a USB-C port can mean everything from USB 2.0 speeds to 10Gbps USB 3.1. It can also mean Thunderbolt. Welcome to the messy world of Type C ports.

That's not to belittle Type C, whose reversible connector is a joy. With older Type A USB connectors,

The reversible Type C
USB connector is handy, but no guarantee of 10Gbps USB 3.1 speed.

SanDisk Extreme 900

PROS
· A drive that can hit 10Gbps USB 3.1 speeds!
· Includes both USB Type C and USB Type A cables
· Gives you all the speed you demand in a portable drive

CONS
· As big as a portable hard-disk drive
· Not exactly cheap
· A 10Gbps USB 3.1 port is needed to take advantage of it

$1,000

★★★★⯪

you have a 50-50 chance of plugging one in correctly the first time. (And as most everyone will attest, the 50-percent of the time where you don't have the plug oriented the right way seems to happen more often.)

The SanDisk Extreme 900 is available in 480GB, 960GB, and 1.92TB flavors that retail for $400, $600, and $1,000, respectively, and carry a three-year warranty. However, I found the drives online at Amazon (go.pcworld.com/sandisk900amazon) for about 20 percent less, which puts them on a par with Samsung's T1/T3 price-wise. Compared to other external USB hard drives, which currently run about $75 a terabyte, that's expensive. But for roughly six times the price, you get roughly six times the performance. How many products of any type can say that?

Performance

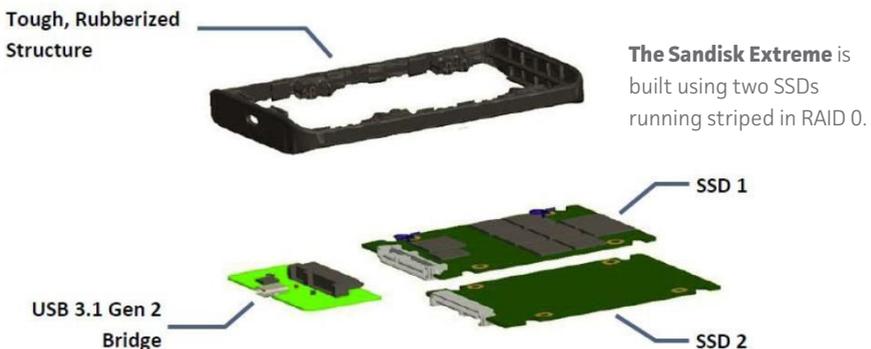For our first test, we trotted out AS SSD, which rated the Extreme 900 at 796MBps when reading sequentially. Because of the Extreme 900's TLC NAND, AS SSD write performance varied from 781MBps when the TLC-as-SLC (Single Level Cell/1-bit) cache was in play, to 598MBps when the cache was exceeded. In normal use, you'll generally see the higher number. But either way, we're talking about an external drive
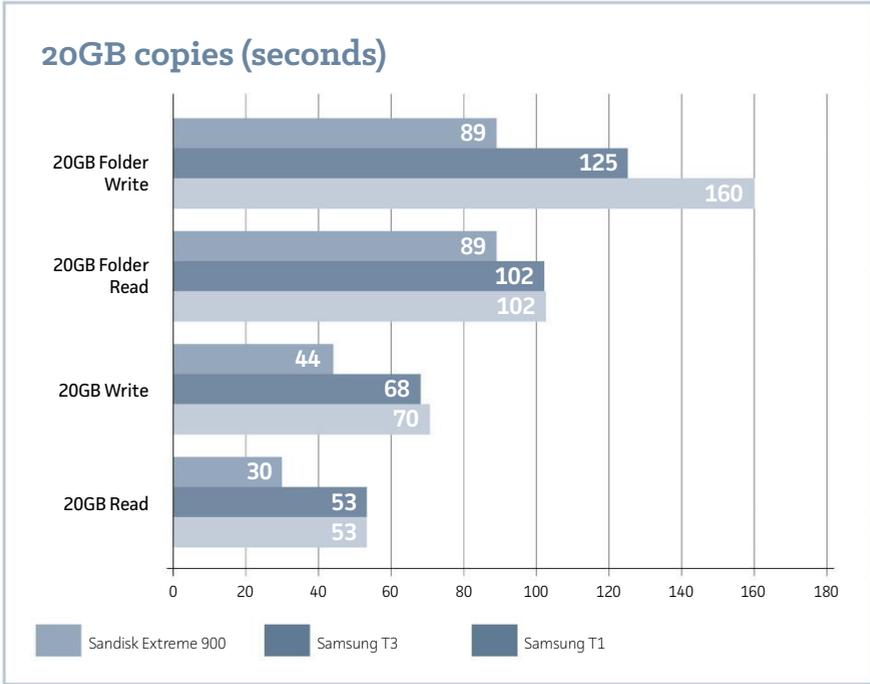
that's almost 400MBps faster reading, and at a minimum, 200MBps faster writing than its closest competitor. Note that SanDisk wouldn't tell us how much TLC was used as SLC cache, but in the industry so far it's generally between 1.5% and 2% of total capacity.

Reading/writing a single 20GB file hit speeds of 666MBps and between 550MBps and 454MBps, respectively. The speed was again dependent upon whether the cache was in play. If we started consecutive operations too soon, the numbers dropped. Note that our real-world copy tests are always slower than the numbers generated by synthetic benchmarks.

The Extreme 900 ships formatted in universally readable/writable exFAT, so it can be used with any device that can deal with USB mass storage. But exFAT is the performance kiss-of-death when writing (not reading) small files and folders; formatted in exFAT, it took the Extreme 900 nearly four minutes (84MBps) to copy our 20GB mix of files and folders. After reformatting to NTFS, that dropped to 89 seconds (224MBps). Even with NTFS, that's considerably slower than the sequential numbers.

There's one large caveat with 10Gbps USB 3.1 in general: You'll find it only on newer PCs, and not even all of those. To benchmark SanDisk's drive on our year-old testbed, we had to grab a $36 Atech Flash Technology Blackbird MX-1 USB 3.1 Gen II Host Card add-in card. It was

Tough, Rubberized Structure

The Sandisk Extreme is built using two SSDs running striped in RAID 0.

SSD 1

USB 3.1 Gen 2 Bridge

SSD 2

20GB copies (seconds)

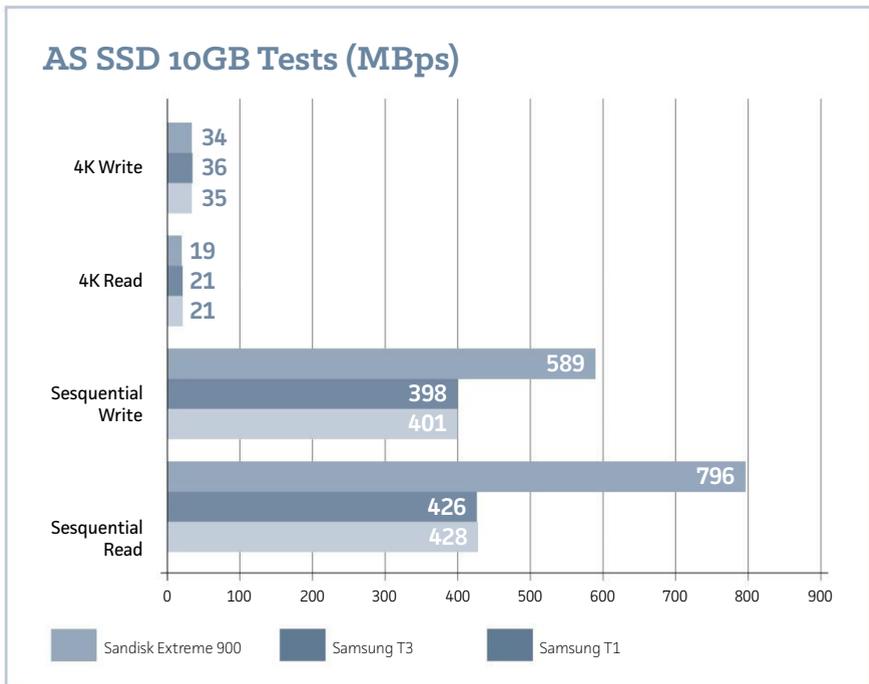| Test	Sandisk Extreme 900	Samsung T3	Samsung T1
20GB Folder Write	89	125	160
20GB Folder Read	89	102	102
20GB Write	44	68	70
20GB Read	30	53	53

If you want to cut your backup and copy times drastically, buy a USB 3.1 10Gbps card and the Extreme 900. All results reflect NTFS formatting, rather than the exFAT it ships formatted to. (Shorter bars are better).

well worth it, but it's a solution that laptop users won't be able to enjoy.

Instead, laptop owners are stuck with whatever their machine supports out of the box. On laptops with Thunderbolt 3.0 ports, you'll also get 10Gbps speeds, but only on those using Intel's high-speed Alpine Ridge controller. Even so, the Extreme 900 is a good performer using 5Gbps USB 3.1 or 3.0. It clocked write speeds of 420MBps and read speeds of about 410MBps—as fast or faster than any external USB SSD on the market. And, of course, you get your speed bonus when you move to 10Gbps USB.

Conclusion

Color me impressed. Not only is SanDisk the first major player out there with a 10Gbps USB drive, but the company has implemented it extremely well. I wish MLC (Multi-Level Cell/2-bit) NAND were used, for more consistent write performance, but even the TLC numbers are impressive. The upshot is that the SanDisk Extreme 900 has permanently banished 5Gbps drives like the T1 and T3 to ho-hum-ville. Begone! ⏻

AS SSD 10GB Tests (MBps)

	Sandisk Extreme 900	Samsung T3	Samsung T1
4K Write	35	36	34
4K Read	21	21	19
Sesquential Write	401	398	589
Sesquential Read	428	426	796

The Extreme 900 bested Samsung's T1/T3 by a considerable margin using USB 3.1 Generation 2. It was also faster on USB 3.x Gen 1. Note that we actually saw up to 780Mbps writing, but we stuck with the slower results. (Longer bars are better).

Raspberry Pi 3: The revolutionary $35 mini-PC cures its biggest headaches

BY BRAD CHACOS

MY, HOW DECEIVING looks can be.

At first blush, the Raspberry Pi 3 Model B (go.pcworld.com/ element14) appears physically identical to the year-old Raspberry Pi 2 Model B: the same port selection, the same GPIO pin layout, the same basic board layout, et cetera. But don't let that fool you! The leap to the Raspberry Pi 3 is just as significant as the prior upgrade, super-charging performance even further and eliminating what few linger-ing setup hassles remained in the Raspberry Pi formula, all while

68

maintaining the same dirt-cheap $35 price point.

But while the Raspberry Pi 3 is easily the most convenient and powerful Raspberry Pi ever, and the first that can potentially be used as a proper PC, it's still more of an evolutionary upgrade than a revolutionary one—which is actually a good thing, as it helps the RP3 maintain backward compatibility with previous generations of the beloved mini-PC and maker board.

Official distributor Element 14 (go.pcworld.com/element14) sent us a Raspberry Pi 3 Model B to test, so without further ado, let's dig in!

Faster, better, harder, stronger

The appeal of the Raspberry Pi has always lain in what you do with it rather than raw tech specs, but it's the hardware that lets you create surprisingly practical (go.pcworld.com/practicalraspberrypi) Raspberry Pi projects and insanely creative inventions (go.pcworld.com/coolraspberrypi) alike. Before we dive into the changes and performance, here's a quick spec breakdown:

- **SoC:** Broadcom BCM2837 64-bit system-on-chip with four ARM Cortex-A53 CPU cores clocked 1.2GHz
- **CPU:** 4X ARM Cortex-A53, 1.2GHz
- **GPU:** Broadcom VideoCore IV
- **RAM:** 1GB LPDDR2 (900MHz)
- **Networking:** 10/100 ethernet, 2.4GHz 802.11n wireless
- **Bluetooth:** Bluetooth 4.1 Classic, Bluetooth Low Energy
- **Storage:** microSD
- **GPIO:** 40-pin header, populated
- **Ports:** HDMI, 3.5mm analogue audio-video jack, 4X USB 2.0, ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)

The Raspberry Pi Foundation Raspberry Pi 3 Model B

AT A GLANCE
The Raspberry Pi 3's subtle improvements add up, supercharging performance even further and eliminating what few lingering setup hassles remained in the Raspberry Pi formula, all while maintaining the same dirt-cheap $35 price point.

PROS
· Fastest Raspberry Pi yet
· Built-in Wi-Fi and Bluetooth
· Big boost in overall usability

CONS
· Setup may be imposing for some people
· Requires several accessories to use

$35

★★★★⯪

The Raspberry Pi 3 next to a first-gen Moto X with a 4.7-inch display, for size comparison.

The card-size Raspberry Pi 3's newfound power lies in a trio of upgrades: A new system-on-chip (SoC) with more potent graphics and computing capabilities, onboard 2.4GHz 802.11n Wi-Fi, and onboard Bluetooth 4.1/Low Energy support.

The new features seem insignificant on paper, but they add up to a serious usability boost in the real world—especially the onboard wireless capabilities, which just plain work out of the box with the default/recommended Raspbian operating system. Developing a Raspberry Pi-specific OS to work solely with Raspberry Pi hardware pays dividends in ease of use, it seems, especially since standard Linux installations are notorious for finicky wireless connectivity. The mere fact that integrated Wi-Fi exists is a huge step up from previous Raspberry Pi models, which required that you either pony up cash for a Wi-Fi adapter or hardwire your board via an ethernet connection.

That's not the only concession to convenience introduced in the Raspberry Pi 3. One of the biggest headaches with the original Raspberry Pi was simply connecting everything you needed to it, as the initial version featured only a pair of USB 2.0 inputs. Connecting the basics—a USB keyboard, mouse, and Wi-Fi adapter—required a USB hub, not even mentioning external storage drives or any other gear you'd like to connect to the board. The Raspberry Pi 2 cured that headache by doubling the number of USB ports to four. The Raspberry Pi 3 goes one step further with native Bluetooth compatibility, which comes in handy for connecting wireless peripherals (take note, folks

who use the Raspberry Pi as a cheap media streaming box) or gadgets and sensors for more advanced maker projects.

Adding the wireless capabilities didn't increase the Raspberry Pi's overall footprint, either. The new wireless radio is so small that "its markings can only be properly seen through a microscope or magnifying glass," the Raspberry Pi Foundation (go.pcworld.com/raspberrypi3) boasts.

The Raspberry Pi 3's new SoC also gives it a big leg-up in performance over the Raspberry Pi 2, which itself blew the single-core original Raspberry Pi out of the water. The Raspberry Pis 2 and 3 both rock quad-core processors, but the latest edition features a quartet of Cortex-A53 CPU cores clocked at 1.2GHz, compared to the Raspberry Pi 2's 900MHz ARM Cortex-A7 cores. In other words, the Raspberry Pi 3 has more capable cores running at higher clock speeds. Both pack a
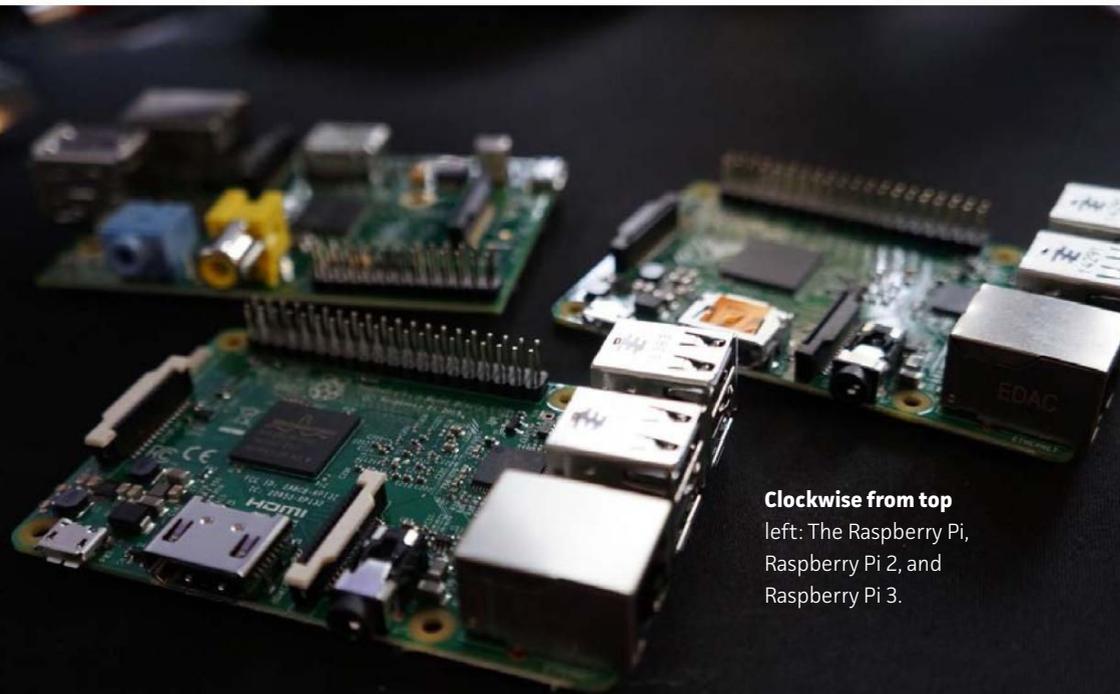
Clockwise from top left: The Raspberry Pi, Raspberry Pi 2, and Raspberry Pi 3.
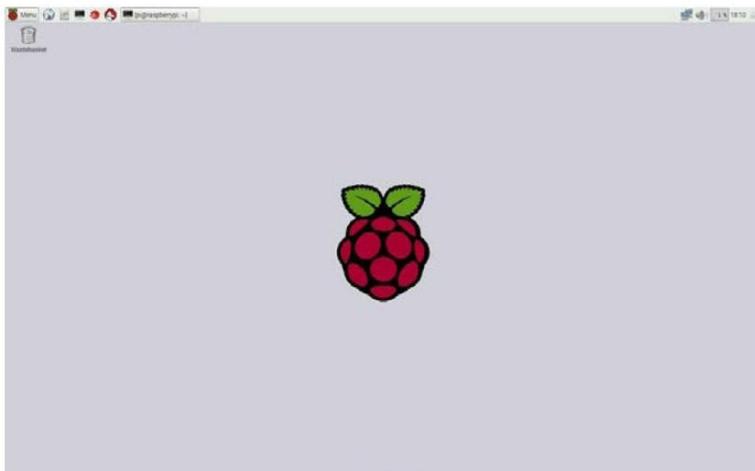
Broadcom VideoCore IV graphics processor, but the speed's been bumped from 250MHz to 400MHz in the Raspberry Pi 3.

Boring numbers aside, the SoC's technical upgrades deliver a hell of a performance and usability upgrade. The Pi's capable of 1080p video playback at 60 frames per second now, up from 30fps prior—though the baked-in Epiphany browser chokes on 60 fps YouTube videos. Local videos as well as YouTube videos watched via the Iceweasel browser (installed separately) ran smooth as silk, however.
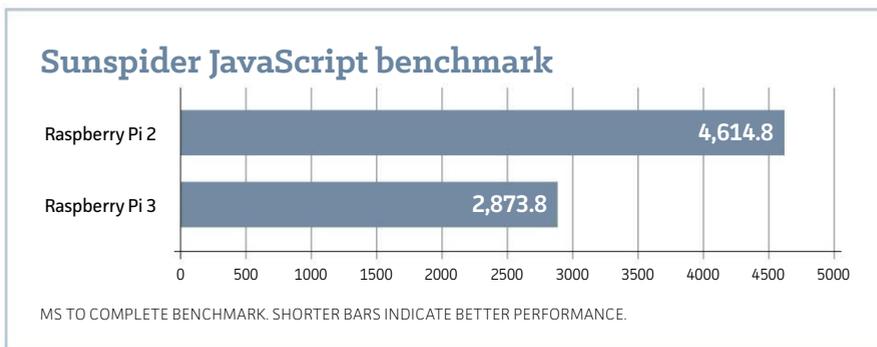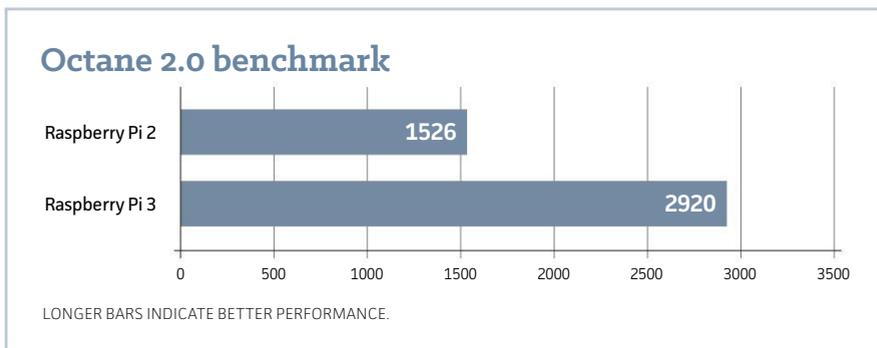
More important is just how much the Raspberry Pi 3 fails to remind you that you're using a $35 computer. Previous versions suffered from annoying pauses and lag when performing even basic tasks like checking Gmail or managing documents with LibreOffice, but those headaches are largely gone in the Raspberry Pi 3. You won't confuse it for a Windows desktop or even a Chromebook, but when Raspberry Pi Foundation founder Eben Upton said (go.pcworld.com/uptonrpi) "This 50–60 percent [performance improvement] has moved us over some sort of line, where it becomes a much more credible PC replacement," he wasn't lying. The Raspberry Pi 3 can definitely handle basic productivity tasks and web browsing.

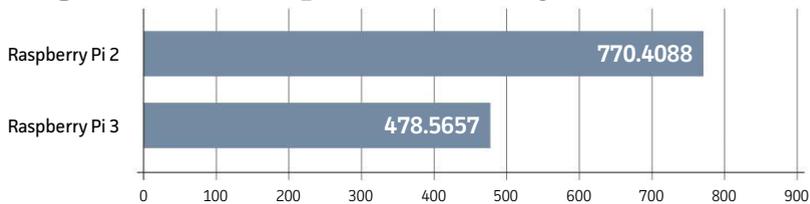Though the Raspberry Pi's ARM-based processors render it

incompatible with many major benchmarks, we ran a handful of tests to quantify the generational improvement. To do so, we loaded the Raspberry Pi 2 and Raspberry Pi 3 with the latest Raspbian Jessie build (raspberrypi.org/downloads/raspbian) maintained on the Raspberry Pi website.

First, we tested both systems with the Sunspider 1.0.2 Javascript (webkit.org/perf/sunspider/sunspider.html) benchmark in Raspbian's default Epiphany browser. The results show how many milliseconds it took to complete the benchmark, so lower results are better. Simply put, the Raspberry Pi 3 blows its predecessor away in pure performance.

The same holds true for Google's Octane 2.0 test (developers.

Octane 2.0 benchmark
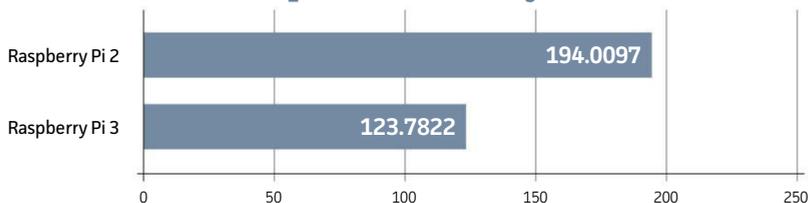
Raspberry Pi 2	1526
Raspberry Pi 3	2920

0   500   1000   1500   2000   2500   3000   3500

LONGER BARS INDICATE BETTER PERFORMANCE.

Sunspider JavaScript benchmark

Raspberry Pi 2	4,614.8
Raspberry Pi 3	2,873.8

0   500   1000   1500   2000   2500   3000   3500   4000   4500   5000

MS TO COMPLETE BENCHMARK. SHORTER BARS INDICATE BETTER PERFORMANCE.

Single-core thread performance, Sysbench

Raspberry Pi 2	770.4088
Raspberry Pi 3	478.5657

SECONDS TO COMPLETE TASK. SHORTER BARS INDICATE BETTER PERFORMANCE.

Quad-core thread performance, Sysbench

Raspberry Pi 2	194.0097
Raspberry Pi 3	123.7822

SECONDS TO COMPLETE TASK. SHORTER BARS INDICATE BETTER PERFORMANCE.

google.com/octane), which we benchmarked using the Iceweasel browser. Higher scores are better. The Raspberry Pi 3 almost doubles the Raspberry Pi 2's results.

We also measured the systems' computing performance directly using the long-running sysbench tool. We configured the test to calculate every prime number up to 20,000 using both a single core, to determine the Raspberry Pi 3's single-thread performance gain...

...as well as on all four of each system's cores. The results show how many seconds it took for each machine to perform the operation, so lower results are better. As you can see, the Raspberry Pi 3 mopped the floor with its opponent yet again, finishing calculations minutes ahead of the Pi 2. Zoom zoom!

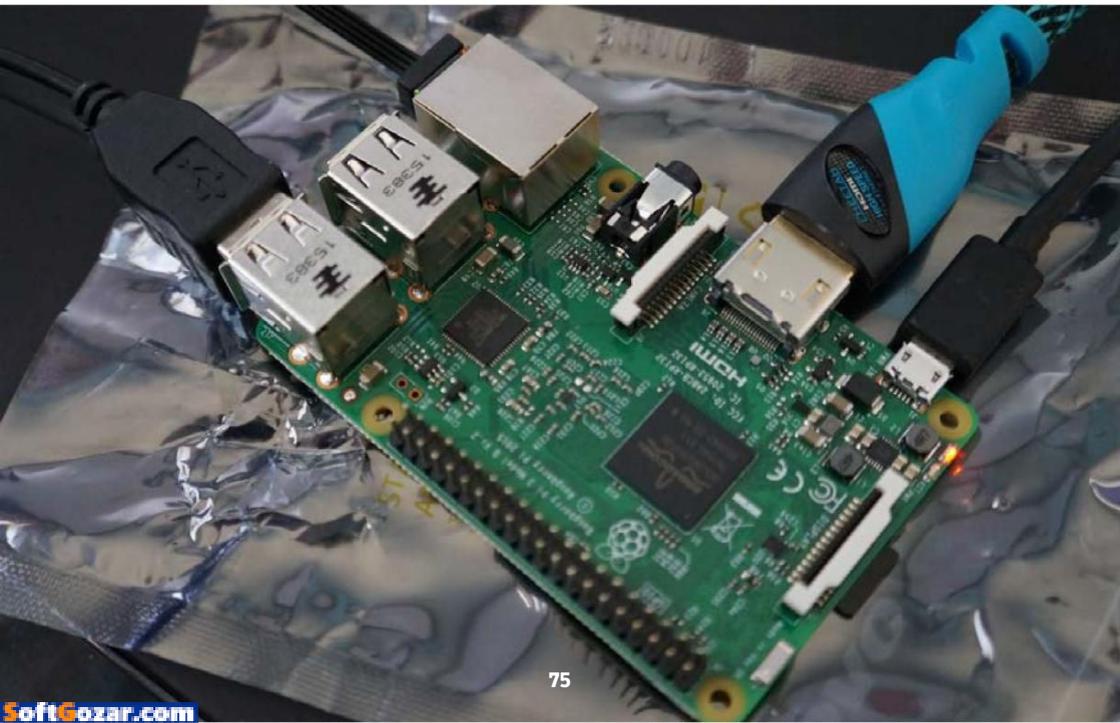And remember: The Raspberry Pi 2 delivered four to five times more

performance than the original Raspberry Pi, so if you upgrade from the original model to the Raspberry Pi 3, prepare to be blown away by its speed.

The whole Pi

It's impressive how (relatively) potent the $35 Raspberry Pi 3 can be, but the board won't work by itself. You'll need to connect it to a monitor or TV via HDMI; connect it to power via a 5-volt micro-USB cord capable of drawing 2.5 amps from the wall (I used a Kindle Fire charger; my Moto X's charger wasn't sufficient); and connect yourself via a USB or Bluetooth keyboard and mouse, though you'll need to set it up using USB peripherals before you can activate Bluetooth pairing. Grabbing a case or at least a box to house the Pi is a swell idea too, because the board is fully exposed in its default state.

You'll also need to bring your own operating system and storage on

The Raspberry Pi 3 needs a lot of extras to work. On the plus side, using Bluetooth peripherals can free up USB ports if you need them.

a microSD card. (There's a good chance you'll need a microSD card adapter to slot the card into a traditional PC and grab that operating system, too.) There is a wide world of Raspberry Pi operating systems (raspberrypi.org/downloads) available, from more general Linux distros to laser-focused OSs built for a specific purpose, like Windows 10 IoT, OpenElec (developer.microsoft.com/en-us/windows/iot/Downloads. htm) for media streaming, or a Raspbian build for Pi-powered weather stations (go.pcworld.com/piweather).

We tested the Raspberry Pi 3 with Raspbian (raspberrypi.org/downloads/raspbian), the Raspberry Pi Foundation's officially supported operating system. The Foundation's Noobs installer tool (raspberrypi.org/downloads/noobs) and setup guide (raspberrypi.org/help/noobs-setup) makes getting your Raspberry Pi up and running relatively easy-peasy, even if OS installations aren't your normal cup of tea.

Raspbian's a fairly stripped-down operating system that drives home the Foundation's original goal for the Raspberry Pi—to create an

Some of the programming software baked into Raspbian.

affordable computer that children can use to learn computer science.

Beyond basic OS tools like image viewers, the Epiphany browser, and the LibreOffice productivity suite, Rapbian's packed with development software. You'll find versions of Wolfram Mathematica, Python program creation tools, and Java integrated development environments, along with more directly entertaining educational software like Scratch, an animation coding IDE for kids, and Sonic Pi, "an open-source programming environment, designed for creating new sounds with code in a live coding environment." There's also Minecraft Pi (raspberrypi.org/learning/getting-started-with-minecraft-pi), a version of that blockbuster game that requires you to use Python programming environments and ping the Minecraft Python API (among other things) to play it.

Raspbian also houses a central Pi Store with hundreds and hundreds of additional tools, or you can always take the code-centric focus to heart and grab new software via a Terminal window. (Read: the

command line.) Raspbian offers everything you need in a basic operating system.

Bottom line

And that's crucial, because the Raspberry Pi 3's performance is finally good enough to allow it to function as a basic PC, rather than being restricted to wild maker projects (go.pcworld.com/coolraspberrypi) or more practical purpose-driven singular uses (go.pcworld.com/practicalraspberrypi). The Raspberry Pi 3 can still perform those specialized tasks, of course—and better than ever!—but now it can do more. I'm probably going to set up my daughter with one for her schoolwork, which is something I'd never have considered with the previous Raspberry Pi models.

On paper, the Raspberry Pi 3 is just a more capable version of its predecessors, but it's so much more than that in reality. While the Raspberry Pi 2 cured the original model's pokey

While the Raspberry Pi 2 cured the original model's pokey performance and paltry port selection, the Raspberry Pi 3's extra oomph and new wireless capabilities help push it over a crucial usability hump.

performance and paltry port selection, the Raspberry Pi 3's extra oomph and new wireless capabilities help push it over a crucial usability hump. The connectivity hassles are gone. The slow and stuttering core experience feels smooth—or at least smooth enough—now. You no longer have to fight with the Raspberry Pi just to use it.

And the Raspberry Pi 3 manages to achieve all that despite sticking to the same $35 price point. If you've ever had any interest in picking up a Raspberry Pi to tinker with, or simply want a dirt-cheap productivity computer, HTPC, or file server, the Raspberry Pi 3 comes highly recommended. It's delicious. ⏻

USB Type C speed test: Here's how slow your laptop's port could be

BY GORDON MAH UNG

USB TYPE C is the intriguing new port that began appearing in laptops, tablets, phones, and other devices well over a year ago, but we had no real way to test its throughput performance until now. Thanks to SanDisk's Extreme 900 (review on page 62), we're finally able to push that tiny reversible port to its limits. To do that, I gathered up no fewer than eight laptops equipped with USB Type C ports, and threw in a desktop PCIe card for good measure too.

Watch the video at go.pcworld.com/usbc explained

IDG.tv

SoftGozar.com

What your USB Type C port isn't telling you

USB Type C is supposed to be a universal standard, but it's just universally confusing. A USB Type C port can run at either 5Gbps or 10Gbps and still be labeled USB 3.1 by the laptop maker. USB Type C even technically supports USB 2.0 speeds at a pathetic 480Mbps. So when you see a USB Type C port, the only assumption you can make is that its transfer speeds can vary from as low as 480Mbps to as high as 10Gbps.

To muddy things even further, Intel's Thunderbolt 3 technology uses the same USB Type C port for transfers over PCIe. It'll also support USB 3.1's 10Gbps.

There's a longer discussion to be had about Thunderbolt 3 and video-out support over USB Type C, but that's for another day. I did, however, write about Power Delivery and not-so-universal (go.pcworld. com/usbcuniversal) charging on USB Type C (hint, it's a bit of a mess).

What's probably in your laptop

A few key factors impact performance over USB Type C. Obviously, the first is your PC's source drive. If you're copying from an internal hard drive, for example, you won't get near the speed of the port, because most drive interfaces can't match USB Type C's top speed.

The other major factor is the controller chip that's used for the port. There seem to be two popular chips on the market today. The first is ASmedia's ASM1142. It's a USB 3.1, 10Gbps chip found in a lot of the early

The SanDisk Extreme 900 drive is among the first true USB 3.1 10Gbps drives we've seen.

laptops and desktops that implemented USB-C. I didn't have a laptop with the controller, so I threw an Atech BlackB1rd MX1 PCIe card with the controller into a desktop system. The performance should be pretty much the same as you'd get out of a laptop. Intel's pricey Thunderbolt 3 chip, which includes USB 10Gbps capabilities, is another candidate.

   The last option you'll find in many laptops is the USB 3.0 controller built into the Intel core logic chipset. This same chip controls the standard USB 3.0 Type A square ports. Many PC makers simply plumb this signal into the oval USB Type C connector. This is actually the most common solution because it's cheaper and doesn't consume more power. However, its presence also means that any USB 3.1 Type C port is stuck at USB 3.0's maximum speed of 5Gbps.

How we tested
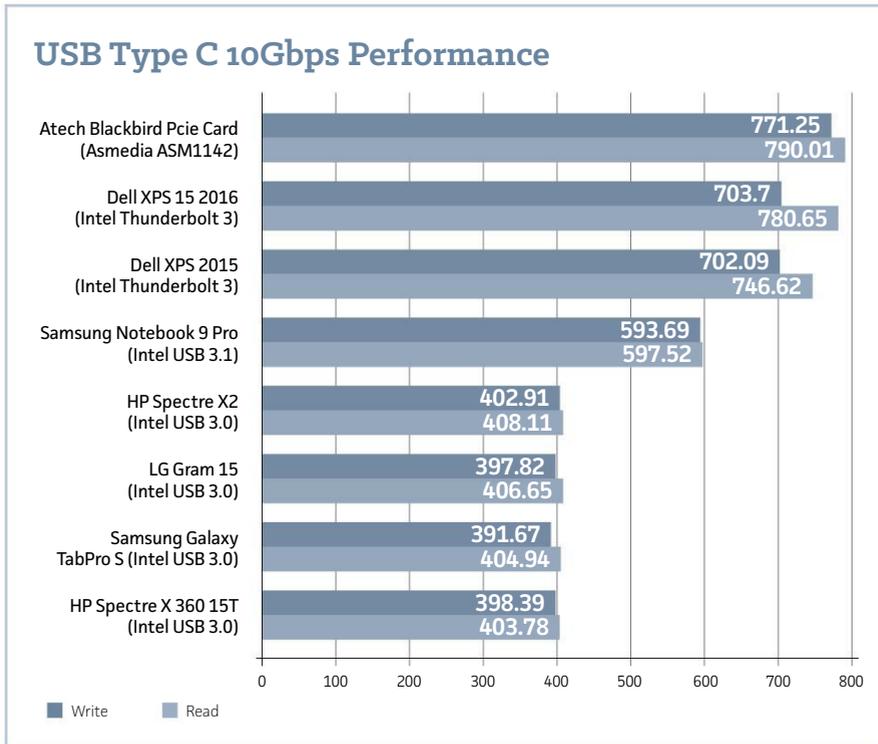
For our test, I used SanDisk's Extreme 900 SSD, which supports USB Type C at 10Gbps speeds. SanDisk builds this 2TB drive by wiring two

Not all USB Type C ports are created equal.

M.2 SSDs in RAID 0 internally. It's pretty blistering fast for a USB drive. Plugging into each laptop's USB Type C port, I then ran the AS SSD storage benchmark for pure sequential transfer speed across the port.

The results speak for themselves in the benchmark chart below, ranked from highest- to lowest-performing. Each entry lists the laptop make and model along with the USB controller.
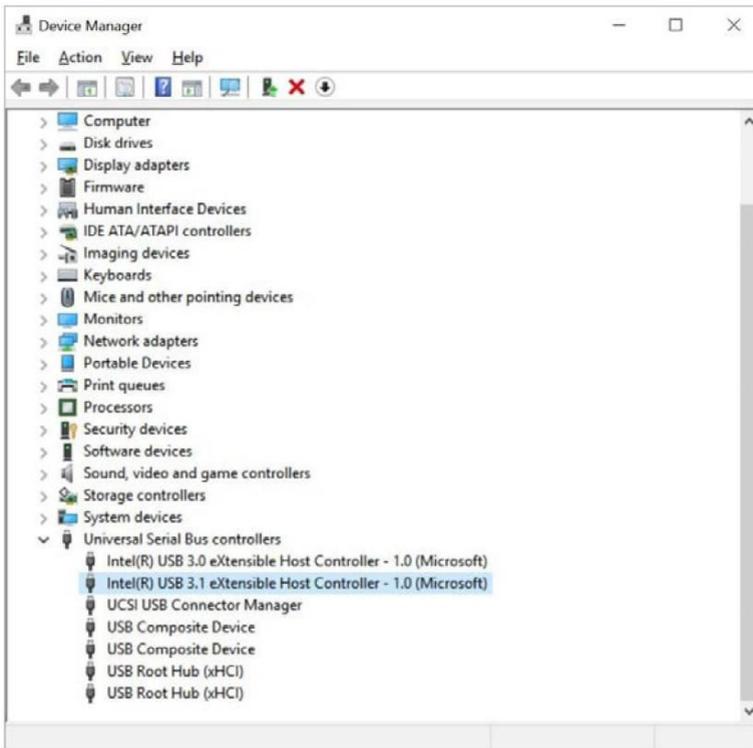
No surprise, the laptop makers that resorted to the lowest-cost option (wiring the included Intel USB 3.0 5Gbps controller to the USB Type C port) give you, well, 5Gbps performance. I didn't test a 12-inch MacBook because AS SSD doesn't run in OS X, but it uses the same controller, so expect it to be similar to the others here.

Of greater interest is the performance of the 10Gbps chips: the

USB Type C 10Gbps Performance

Laptop (Controller)	Write	Read
Atech Blackbird Pcie Card (Asmedia ASM1142)	771.25	790.01
Dell XPS 15 2016 (Intel Thunderbolt 3)	703.7	780.65
Dell XPS 2015 (Intel Thunderbolt 3)	702.09	746.62
Samsung Notebook 9 Pro (Intel USB 3.1)	593.69	597.52
HP Spectre X2 (Intel USB 3.0)	402.91	408.11
LG Gram 15 (Intel USB 3.0)	397.82	406.65
Samsung Galaxy TabPro S (Intel USB 3.0)	391.67	404.94
HP Spectre X 360 15T (Intel USB 3.0)	398.39	403.78

■ Write   ■ Read

ASMedia chip and the Thunderbolt 3. In the chart, that's represented by the two Dell XPS laptops for Thunderbolt and the ASMedia chip in the desktop. In these tests, the ASmedia has a slight edge on the Thunderbolt 3 controller. Vendors have told me their own internal testing backs that up.

There's one more rather interesting wildcard in the test, and that's the Samsung Notebook 9 Pro laptop. This 15.6-inch laptop takes a rather unusual approach with its USB Type C port by integrating an Intel Alpine Ridge Thunderbolt 3 chip, but opting to use only the USB support in it. In the device manager, it even shows up as an Intel USB 3.1 controller as you can see from the screen shot above.

Samsung officials confirmed the laptop doesn't support

Thunderbolt 3. I even tested it with an Akitio Thunderbolt 3 drive to confirm. Why Samsung did this I just don't know.

I do know that the performance was oddly slower. It was faster than the plain-jane USB Type C port that uses the Intel chip, but slower than the ASMedia and full Thunderbolt 3 laptops. Weird.

Conclusion

One look at the benchmark chart should tell you that there are real hard benefits to having a full USB 3.1 10Gbps port in a laptop or desktop PC. The most obvious is the time saved waiting for files to copy to your USB drive. The other is taking full advantage of that great new USB 3.1 10Gbps drive you just bought. As USB Type C ports start appearing on more machines, it'll pay to read the fine print in the specs. ⏻

4 password managers that make online security effortless

BY MICHAEL ANSALDO

THERE'S A REASON the sequence 123456 remains the most popular password. We tend to use passwords we can easily recall. And that means they're easy to hack.

A good password manager is the best way to relieve the burden of memorizing complex logins and keep your data secure. These tools encrypt your login info in a virtual vault—either locally or in the cloud—and lock it with a single master password.

Considering that the security of sensitive data is at stake, you shouldn't take choosing a password manager lightly. This guide will tell you what features to look for in a password manager and compare four of the best.

What to look for

Password managers come with myriad features, but at a minimum they should have the following capabilities:

- **Password generation:** The strongest passwords are long, random strings of characters (go.pcworld.com/strongpwds). And you should use a unique one for each site you access. That makes password generation—the ability to create complex passwords out of letters, numbers, and special characters—an essential feature of any good password manager. If it can analyze your existing passwords for weaknesses and upgrade them, even better.
- **Auto-fill and auto-login:** Ideally, your master password is the only one you should have to enter when using your password manager. The best ones will auto-fill your login credentials when you visit a site. Some will even log you in automatically when you launch your account.

> Ideally, your master password is the only one you should have to enter when using your password manager.

- **Secure sharing:** There will inevitably be times when you need to share a password with a coworker or family member. Unlike text messages or email, a password manager should let you share without compromising your security.
- **Two-factor authentication:** To an enterprising cyber criminal, your password manager's master password is no different than any other password, meaning it's obtainable. To safeguard against unauthorized access to your password vault, look for a manager that supports multi-factor authentication—for instance, the addition of a randomly generated code that's texted to you when you log in.

- **Cross-platform:** We all work on multiple devices and operating systems. So should your password manager.

LastPass

One of the first full-featured password managers, LastPass (lastpass. com) remains the gold standard. This combination vault, form-filler, and password generator creates strong multi-character passwords; supports auto-login; offers one-click password changing; and even lets you audit all your stored passwords for weaknesses.

Once you've installed the LastPass plug-in in your browser, it prompts you to save your credentials each time you log in to a site for the first time. When you return to a site, a small icon appears in its login fields showing how many accounts you have stored. Click it to see them and select the appropriate one to log in securely.

One of LastPass's best features is auto password change. Rather than manually logging in to an account and changing the password, LastPass will do it with the click of a button for popular sites like Facebook and Amazon. LastPass also recently added an Emergency Access feature that lets you designate trusted people to access your vault when you can't.

LastPass is free to download and use on all desktop platforms. For access to the more advanced features and the mobile apps, you'll need to upgrade to LastPass Premium for $12 a year.

Dashlane

Dashlane (dashlane.com) is proving itself a worthy contender for LastPass' crown. Much of this has to do with its desktop app, which features an intuitive and elegant interface that displays your accounts in a list or as tiles. Dashlane also has plug-ins for the four big browsers for on-the-fly access.

One of Dashlane's most attractive features is its security dashboard.
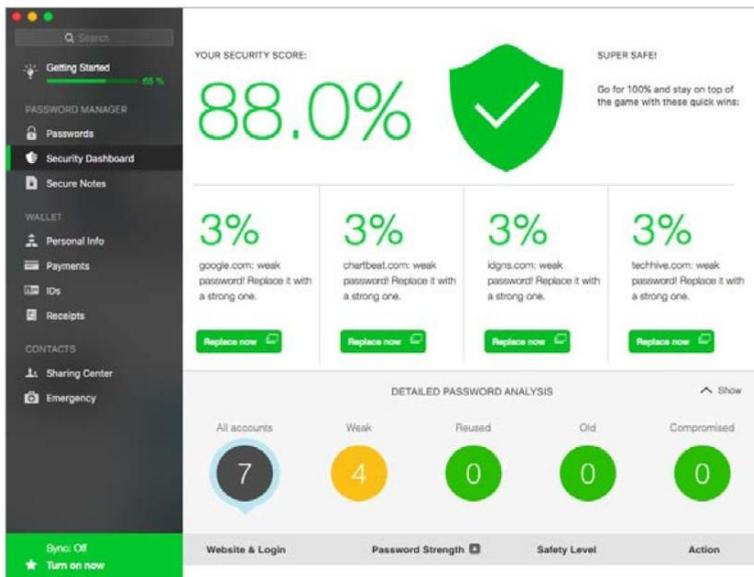
Dashlane's security dashboard shows you password weaknesses and how to improve them.

This gives you an overall percentage rating of your security strength, and offers suggestions for quickly improving it (replace your weak Google password with a stronger one for a 3-percent bump, for example). Clicking Detailed Password Analysis gives you a closer look at each of your passwords, which you can sort by website, password, strength, or safety level. Clicking an info button reveals the reasons behind its rating so you can take action to improve it.

Dashlane also supports auto-login, form auto-fill, two-factor authentication, secure sharing with emergency contacts, and automatic password changing for numerous popular sites. It also gives you the option of saving your password database on its servers—which enables you to sync it across devices—or locally in an encrypted vault.

Dashlane is free to use on any device, but to sync your password you'll need Dashlane Premium (dashlane.com/premium) for $40 per year.

1Password

1Password (1password.com) combines the best of LastPass' management features with Dashlane's good looks. As with Dashlane,

you must download the desktop app but you can integrate 1Password into your browser with the appropriate extension. The desktop app also installs 1Password Mini, which gives you quick access to all the app's features from your system tray (Windows) or menu bar (Mac OS).

You'll find all the necessary tools here, including auto-save and auto-fill, password audits, two-factor authentication, and a strong-password generator. For passwords you want to remember yourself, 1Password can also create passwords out of randomly generated words.

A particularly nice feature is 1Password's Watchtower service, which monitors the sites and services for which you have accounts and alerts you to any breaches. 1Password also includes a digital wallet for securely storing credit cards, bank account info, social security numbers, and other sensitive data.

1Password is free to download and use for 30 days and you can purchase a single license for $65. If you want to secure your whole household, choose a 1Password Families subscription for $5 a month.

True Key by Intel Security

The big drawback of any password manager is that you still have to remember your master password. If you forget it, you lose access to all the others. True Key (truekey.com) eliminates this burden by allowing you to log in to the app using something unique to you. Depending on your device, that could be your fingerprint, your face, or a second

True Key offers a **variety** of authentication methods, depending on your device.

device. You can even combine authentication methods for stronger security.

Once you've signed in to True Key, it operates much like other password managers. You access all your logins from a customizable launch pad. Websites can be displayed in a list or as icons. Clicking on an item will take you to that site's login page and fill in your credentials. If you're creating a new account, True Key's password generator will help you create the strongest possible password.

Like 1Password, True Key also includes a digital wallet. Here you can store addresses, credit cards, driver's licenses, memberships, passports, and social security numbers. A Safe Note vaults securely stores any text data you enter.

True Key is free to download and use for up to 15 new logins (though you can import unlimited logins from another manager such as LastPass). For $20 a year, you can upgrade to the premium version. ⏻

'Day of the Tentacle' Remastered: Sludge-o-Matic sucker for love

BY HAYDEN DINGMAN

RECENTLY I PLAYED *Day of the Tentacle* (dott.doublefine.com) legally. Those of you who played it back in 1993 understand why this is such a big deal. And the rest of you? If you're wondering "Why would he start off a review with such a banal statement?" then blame LucasArts.

See, *Day of the Tentacle* is the latest Double Fine re-release, following in the wake of last year's *Grim Fandango Remastered* (go.pcworld.com/grimfandango). Despite being a classic point-and-click—and many people's favorite point-and-click of all time—it's been pretty much

impossible to buy *Day of the Tentacle* for the last fifteen or so years.

And now you can. With spiffy new music and graphics, to boot. It's enough to make you throw up your tiny purple tentacle arms and cheer.

Every tentacle has its day

The sun is shining. The birds are chirping. And a purple tentacle creature named…Purple Tentacle…is drinking toxic sludge out of a river. The Lorax's worst nightmare is Purple Tentacle's coup de grace, a bit of nuclear-bolstered evolution that causes Purple Tentacle to grow arms.

And as is the case for all creatures-with-arms, his next step is to try and take over the world.

Three kids—a nerd named Bernard, a stoner named Hoagie, and a weird hippie named Laverne—are the only ones who can stop Purple Tentacle. Their plan? Travel back in time to yesterday and turn off Dr. Fred Edison's sludge-making Sludge-O-Matic machine.

Brilliant! If only Dr. Fred hadn't built a vital part of his time machine out of discount diamonds! And so it happens that the machine breaks, everything goes horribly wrong, and the three kids are stranded in different eras—Laverne in the tentacle-ruled future, Hoagie in the American Revolution, and Bernard in the present.

It's goofy but clever, and serves as more than just a vehicle for jokes about George Washington's teeth. *Day of the Tentacle*'s time travel is central to the game's best puzzles, with the kids swapping items back and forth across time and occasionally setting up circumstances in the past so something changes in the future.

At the risk of doling out 23-year-old spoilers I'll abstain from laying out any of the puzzle solutions

Day of the Tentacle Remastered

AT A GLANCE
Day of the Tentacle may look new, but this is still the same ol' point-and-click people fell in love with in 1993. For better and for worse.

PROS
· Overhauled art still captures the look and feel of the original
· Clever use of point-and-click conceits

CONS
· Some puzzles are overly quirky/dense
· Can't highlight hotspots in classic pixel art mode

$15

★★★★☆

here, but imagine: You're tired of the sun shining through your bedroom window every morning so you go back in time 100 years and plant a seed and when you go back to the future there's a massive oak tree in front of your house.

Take that puzzle and up the zaniness factor by a million—say, instead of you planting the tree you convince Johnny Appleseed to do it—and you'll have a good idea of the puzzles in *Day of the Tentacle*.

And for the most part, it works. *Day of the Tentacle* isn't nearly as straightforward as most modern point-and-clicks, and this is LucasArts's pun peak, but the game's surprisingly decent at prodding you in the right direction. Plus you now have the ability to illuminate hotspots if you think you're missing something obvious.

Some of the puzzles though…oof. And Double Fine knows it. I've never seen a game more willing to poke fun at its own shortcomings as *Day of the Tentacle* Remastered. Achievements for certain puzzles are titled things like "Obvious, really" and "I forgot this is a cartoon"— tonally appropriate, but also seemingly indicators that Tim Schafer and Co. recognize the leaps in logic required by some of the game's more ridiculous moments.

There's no way to fix it, of course. Or, rather, if it was "fixed" then *Day of the Tentacle* purists would rage until they sprouted arms and enslaved humanity.

But keep it in mind if you've never played *Day of the Tentacle* before: This is most definitely an adventure game from the '90s. Brilliant, but don't be afraid to look up a puzzle solution if you're feeling frustrated.

Face-lift

That's not to say this is a one-to-one port of the 1993 original. Like *Grim Fandango*, *Day of the Tentacle* has received the "Remastered" treatment and in this case Double Fine's done some pretty extensive work.

Most obvious is the art. The original's pixel art has been, it seems, traced over frame by frame in a cleaner, more modern style. Thus you retain the weird (charming) herky-jerky animations of the pixel art but done up for 2016—all smooth lines and soft shading.

Personally I like the pixel art (the bottom image) more, but that's a subjective matter and anyhow you can cycle between both old and new by tapping F1. Which I did. A lot.

Hitting F1 also swaps between the old and new music (chiptunes

versus orchestration) and between the two verb (read: action) inputs. The old method is the classic LucasArts grid in the bottom left, which gives you a lot of freedom to try nonsense answers but necessitates a lot of mouse movement. The alternative is the more modern Dial interface, where right-clicking brings up a list of suggested verbs for each object and then you mouse over to choose.

Best of all, you can mix and match the two *Day of the Tentacle* editions in the menu. I ended up running most of the game with the new art, the dial interface, and the old chiptune music—its off-kilter sound felt more faithful to the game's tone. But you could choose any combination, which is a nice touch for 1993 purists and newcomers alike.

The one caveat: You can't highlight hotspots in the original pixel art.

Bottom line

Day of the Tentacle is a classic, but not in the old musty way where you brush off a copy of some old SNES game and realize it isn't as good as you remember. This is still one of the finest point-and-clicks ever made, with a witty story and some brain-bending puzzles. Also, a hell of a lot of dumb puns.

As with *Grim Fandango*, the big news is that *Day of the Tentacle*'s on sale at all. The fact that Double Fine's put in so much work as caretaker to bring it up to modern—or at least *mostly* modern—standards? Even better. ⏻

THE WINDOWS 10
## ANNIVERSARY UPDATE'S
BEST
NEW
FEATURES
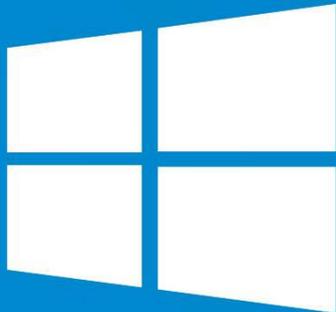
BY BRAD CHACOS

HAPPY BIRTHDAY, WINDOWS 10

Microsoft's planning a big bash for Windows 10's first birthday, and you're the one receiving presents. This summer, the company will push out the free (and boringly named) Windows 10 Anniversary Update (go.pcworld.com/win10anniupdate) 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.

It'll be a few months before the Windows 10 Anniversary Update rolls out, but Microsoft's already revealed many of its new features. Even better: If you don't mind living dangerously with unfinished software, you can try many of these new features in Windows 10 preview builds (go.pcworld.com/win10previewbeta) today.

Let's dig in!
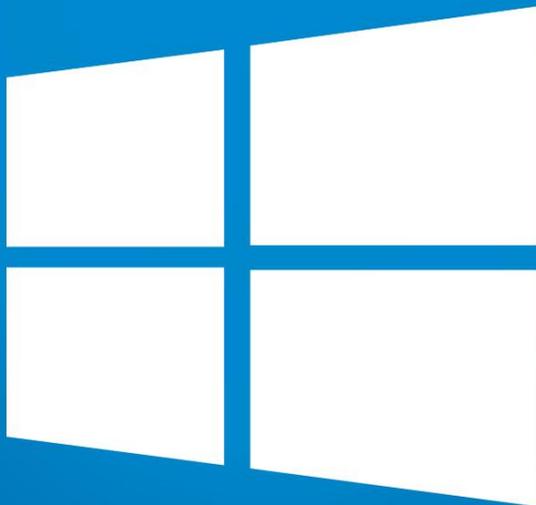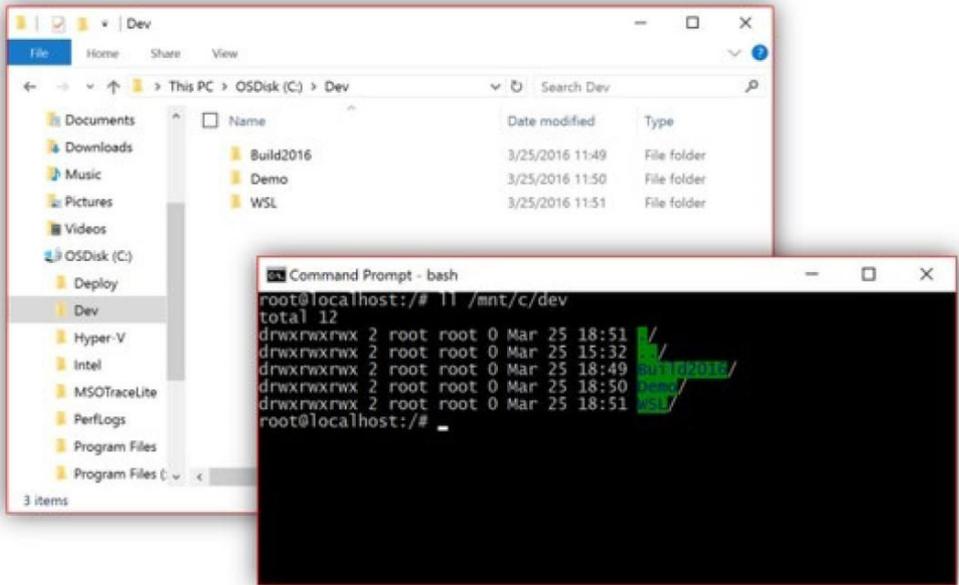
BASH SHELL

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 (go. pcworld.com/w10hhbashshell) deep-dive 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.

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 is getting a feature that lets you pin an open app to all of your virtual desktops—handy if you always want a particular program front and center.

Pinned virtual desktop apps are already in the Windows 10 preview builds. To activate it, 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.
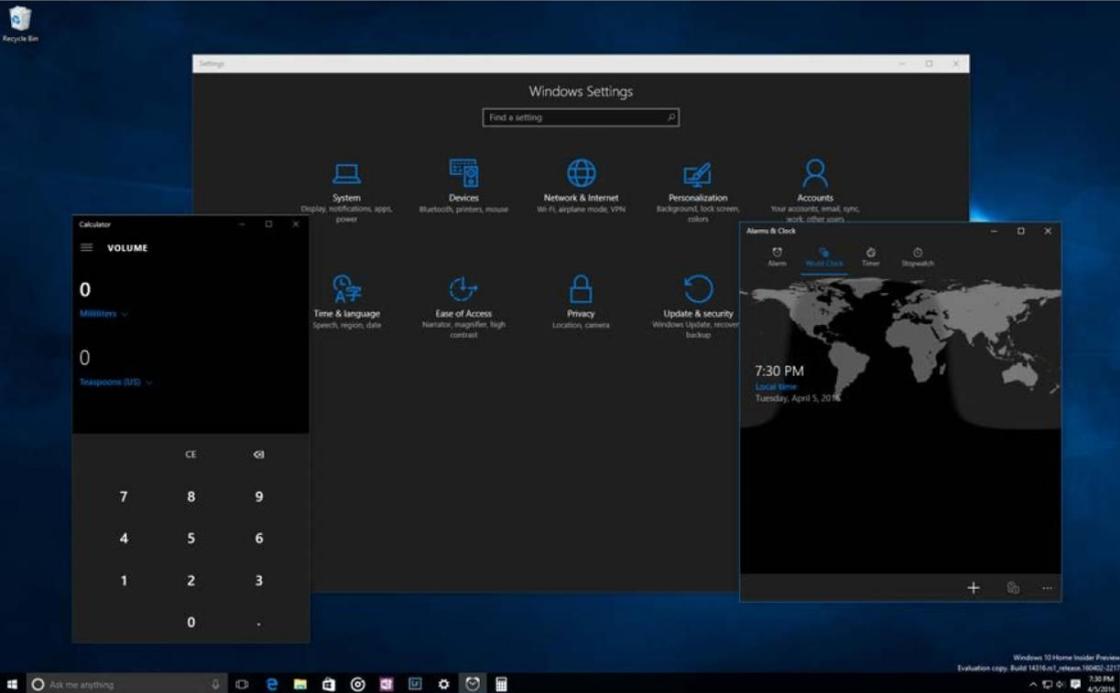
DARK THEME

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

EDGE IMPROVEMENTS

Let's start digging into new features with more widespread appeal. If you use Windows 10's default Edge browser, you'll find some welcome improvements.

First off, Edge is (finally) getting extension support, and early partner extensions are being trialed right now in Windows Insider preview builds. Once extensions are formally rolled out, you'll be able to install them directly from the Windows Store.

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!
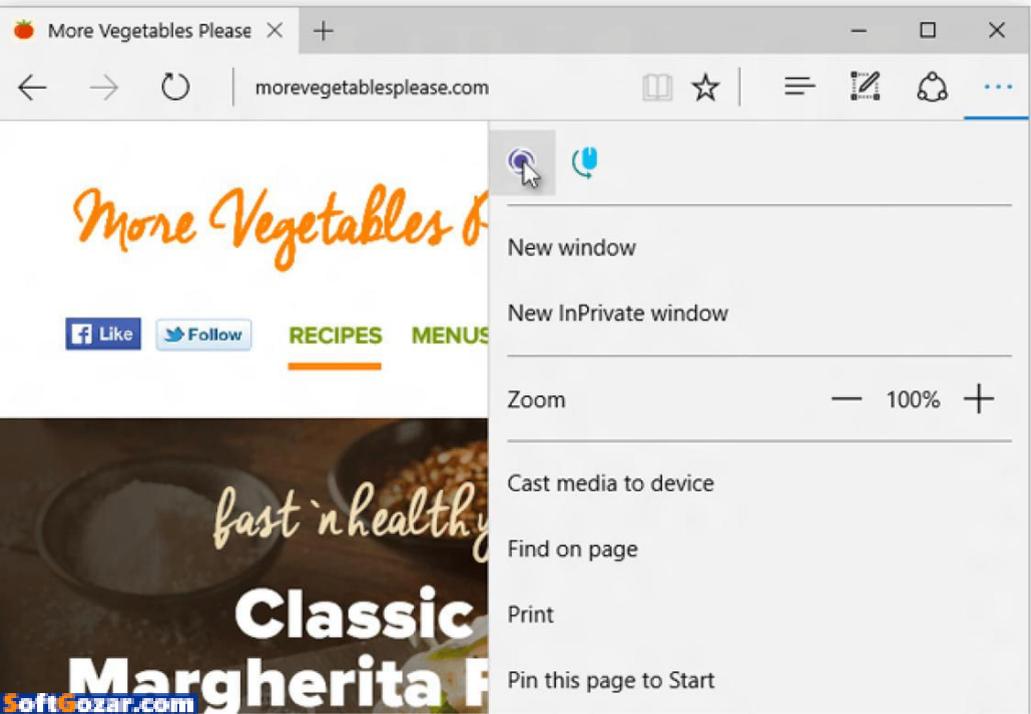
WINDOWS HELLO SAYS HELLO TO APPS AND WEBSITES

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

AN EMPHASIS ON INK

Playing to its productivity strengths, Microsoft's baking numerous inking improvements into the Windows 10 Anniversary Update. You'll be able to pull up a dedicated "ink workspace" (pictured) with tools and apps that support styli, draw a line between two points and annotate stops in-between in Maps, and auto-create Cortana reminders based on written notes, for example. The operating system will also include a "digital ruler" that you can slap onscreen to ensure your digital scribblings line up straight. Nifty!
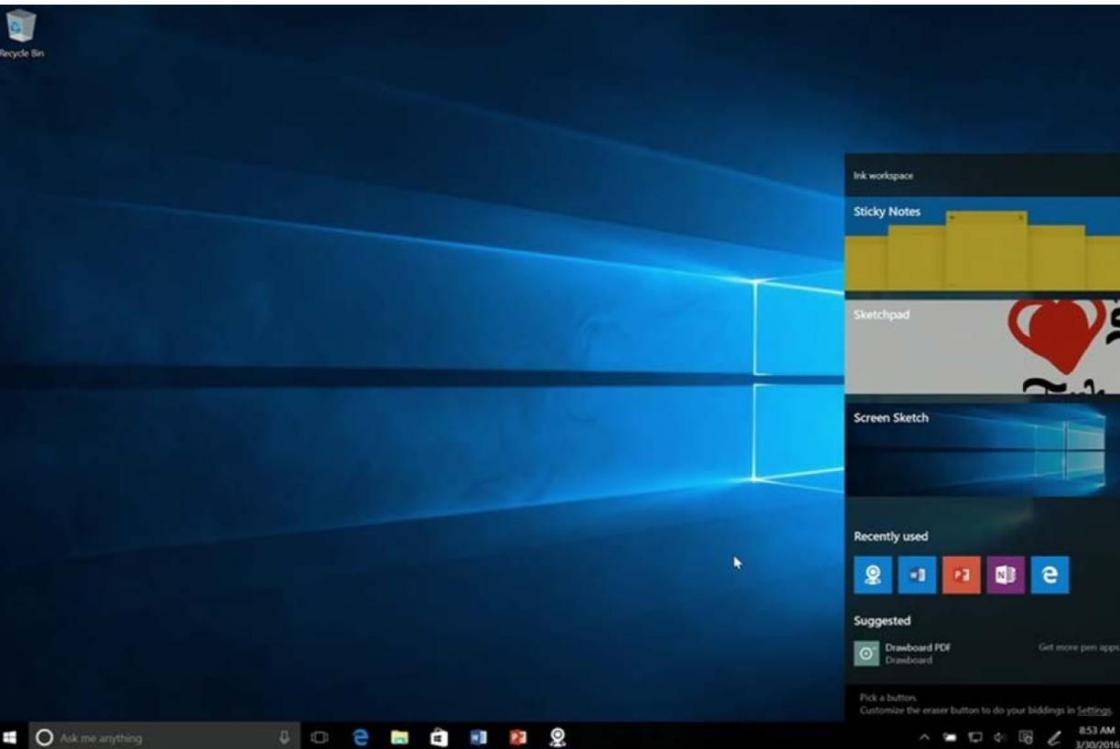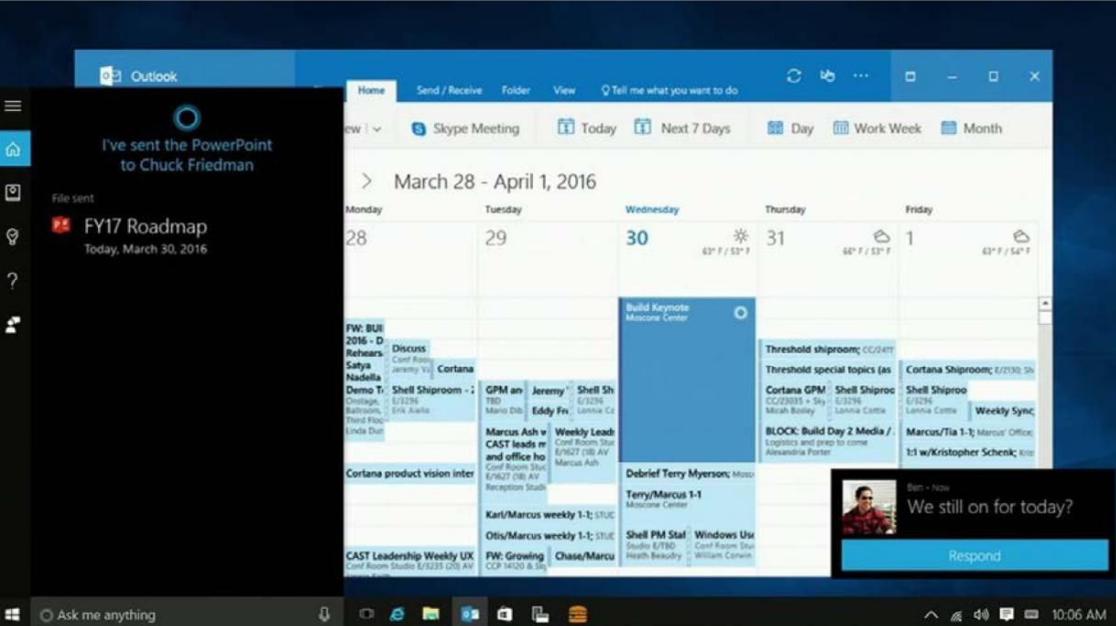
CORTANA GETS SMARTER

Cortana's receiving a barrage of beneficial upgrades, too. Since the digital assistant's powered by Microsoft servers more than Windows 10 itself, there's no guarantee these tweaks will go live alongside Windows 10 Anniversary Update. But since these tweaks were revealed alongside the Update at Build, it seems likely.

Cortana's becoming more proactive (go.pcworld.com/contextualaware) and powerful, as Microsoft grants her greater access into the Office, Outlook, and Calendar apps. That sort of contextual awareness will let 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?" and Cortana will actually understand what you mean. Developers will also be able to bake Cortana into third-party apps.

CORTANA LOVES PHONES

The new and improved Cortana will also gain closer ties to Windows 10 Mobile phones and Android phones with Microsoft's Cortana app installed. (Again, Microsoft hasn't specifically said this will tie into the Windows 10 Anniversary Update, but it seems likely.)

In the future, Cortana will be able to pull notifications and low-battery warnings from your phone and beam them to your PC, cutting back on the need to pull your phone out of your pocket—and the threat of a dead device at the end of the day. The communication will go both ways, too, as you'll be able to pull up Maps directions on your PC and push them over to your phone. Handy stuff.
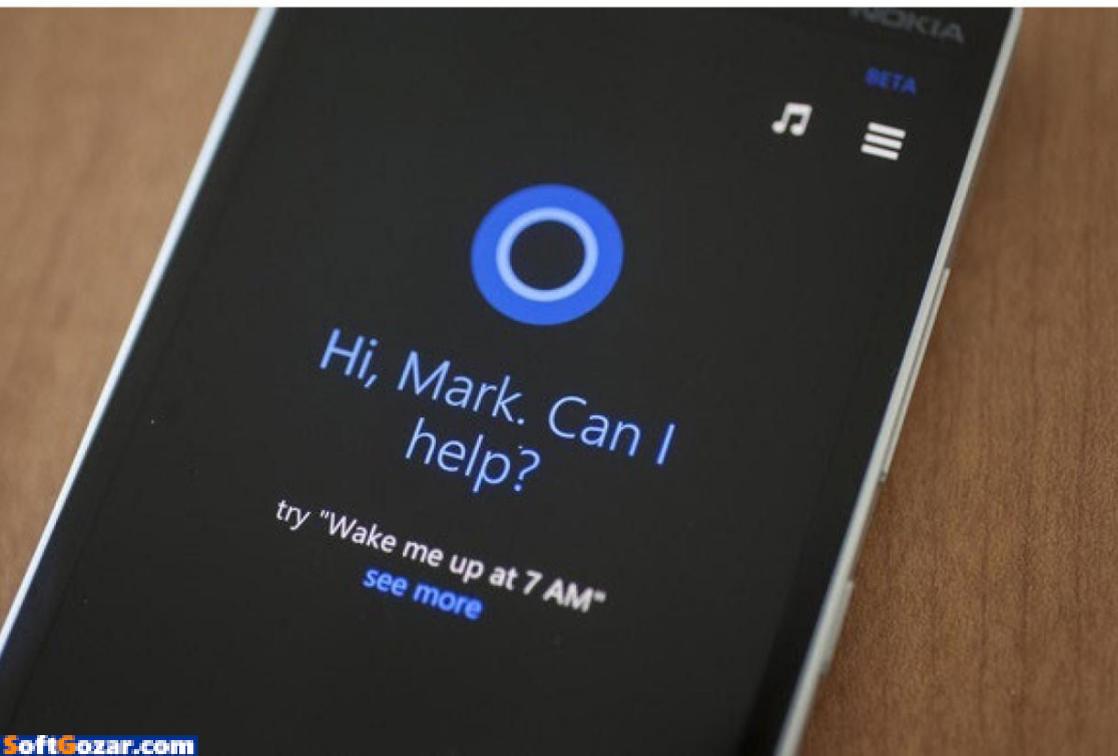
THE CONNECT APP

There are some new apps coming, 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 above.

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 come in supremely handy when it's time to make a presentation.

UNIVERSAL SKYPE APP

Skype rolled out a new Universal Windows Platform (UWP) app for the service with the Windows 10 preview build containing a bunch of these Windows 10 Anniversary Update features. The messaging app's been teasing the universal version of Skype (go.pcworld.com/skypeuwp) for a while now, and the desktop version of Skype for Windows 10 will eventually bow to it completely. If it doesn't go live before the Anniversary Update arrives, expect it to hit the streets in the birthday build.
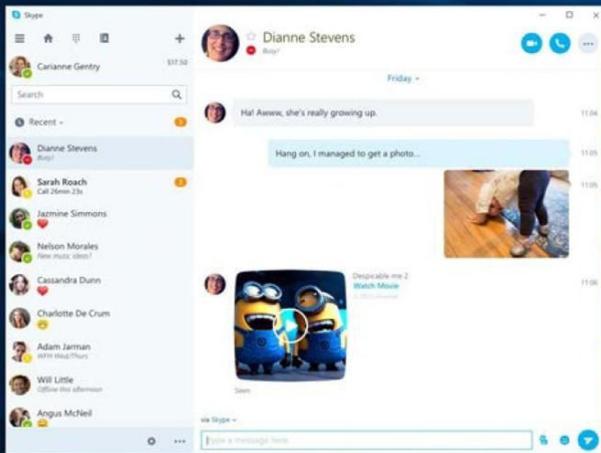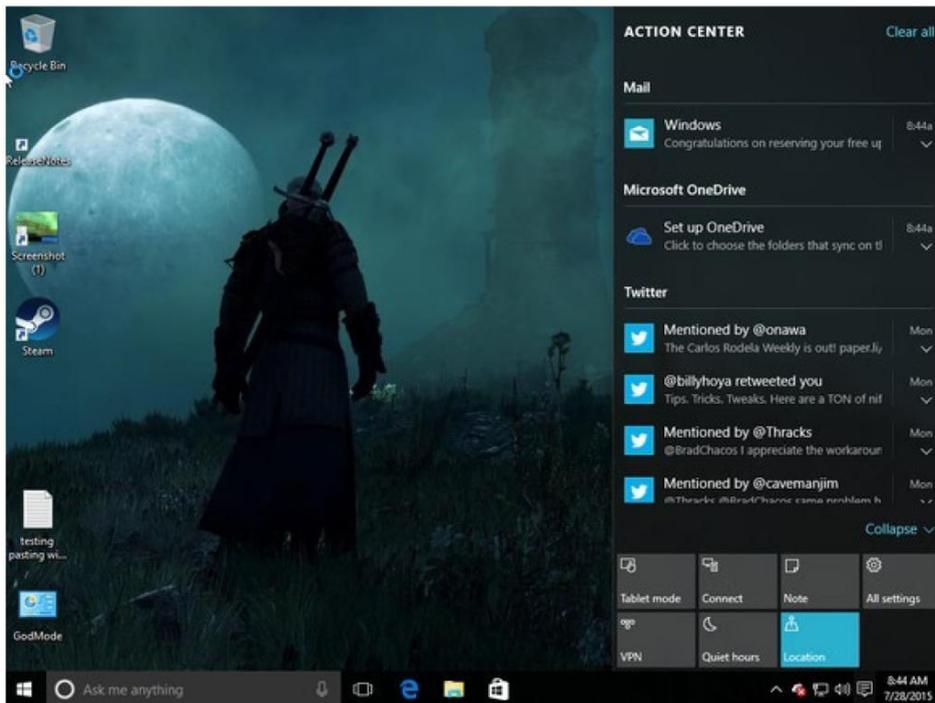
ACTION CENTER TWEAKS

Microsoft's showering the Action Center—Windows 10's notifications hub (go.pcworld.com/w10ac)—with some love, too. The first glimpses of that appeared in the Windows Insider preview build 14316, aka the build that first revealed many of the Anniversary Update's features. In that build, you could set priority levels for individual apps, so that notifications you care about most will 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.

Expect to see more news about Action Center closer to the Anniversary Update's release. In a developer session at Build 2016, Microsoft talked about adding more widget-like interactivity to notifications and the Action Center, and linking the Action Center to Live Tiles in the Start menu so that actions you take in one affect the other.
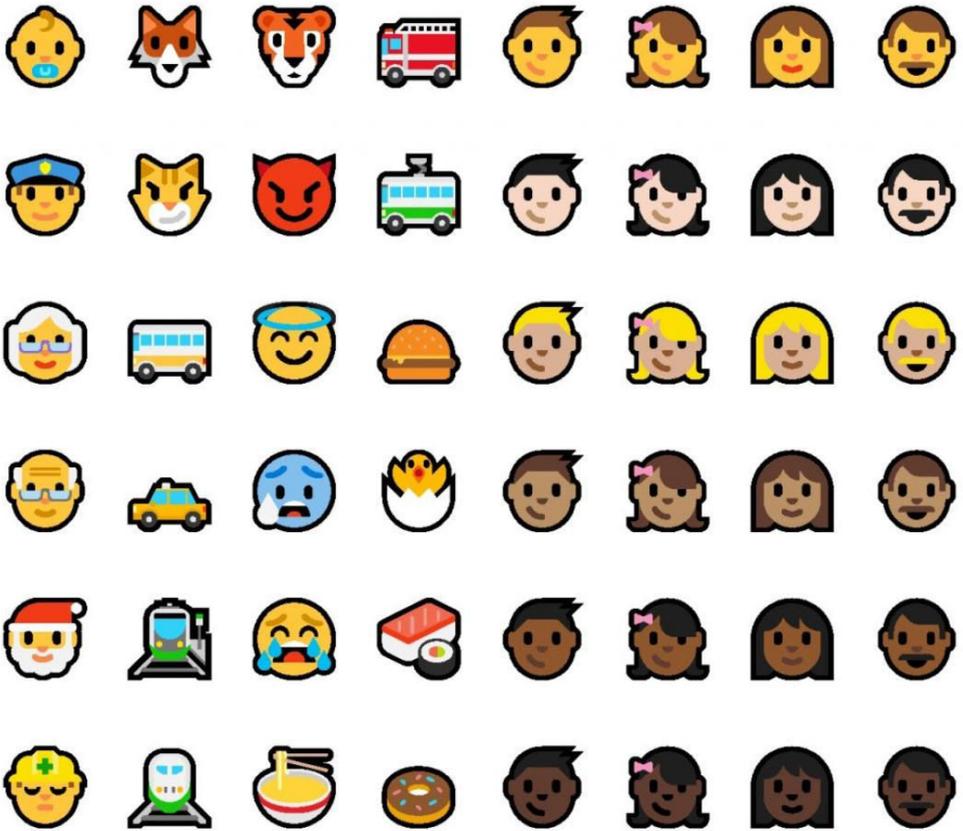
NEW EMOJI

New emoji!

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 will henceforth be 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."

BUT WAIT, THERE'S MORE!

The Windows 10 Anniversary Update will come with other little tweaks and fine-tuning as well. The Windows installation screen will contain more information than before, for example, and you'll be able to comment in the Feedback Hub and tell Windows not to install updates during specific hours. And who knows what else Microsoft has up its sleeve between here and the summer?

But if you'd like to squeeze more oomph out of your PC today, be sure to check out *PCWorld*'s massive roundup of Windows 10's best tips and tricks (go.pcworld.com/w10tips) for helpful tweaks and hidden power-user tools you can use right now. It's nice to look ahead and all, but there's no time like the present to do more with what you already have.

Just because you can't see it doesn't mean it's not there.

Although it's more common in older women, ovarian cancer affects women of all ages, even in their 20s. There is no early detection test, and symptoms can be subtle. But while you can't see it, you can take steps to get ahead of it by knowing your risk factors. Family history of cancer and presence of gene mutations like BRCA are risk factors, so talk to your family and your doctor. This information makes you less likely to ignore vague signs that could indicate disease.

Meanwhile, promising collaborative research will continue to shed light on new advances in diagnosis and treatment of ovarian cancer.

To learn more about symptoms, risk factors and research go to SU2C.org/ovarian

Minnie Driver
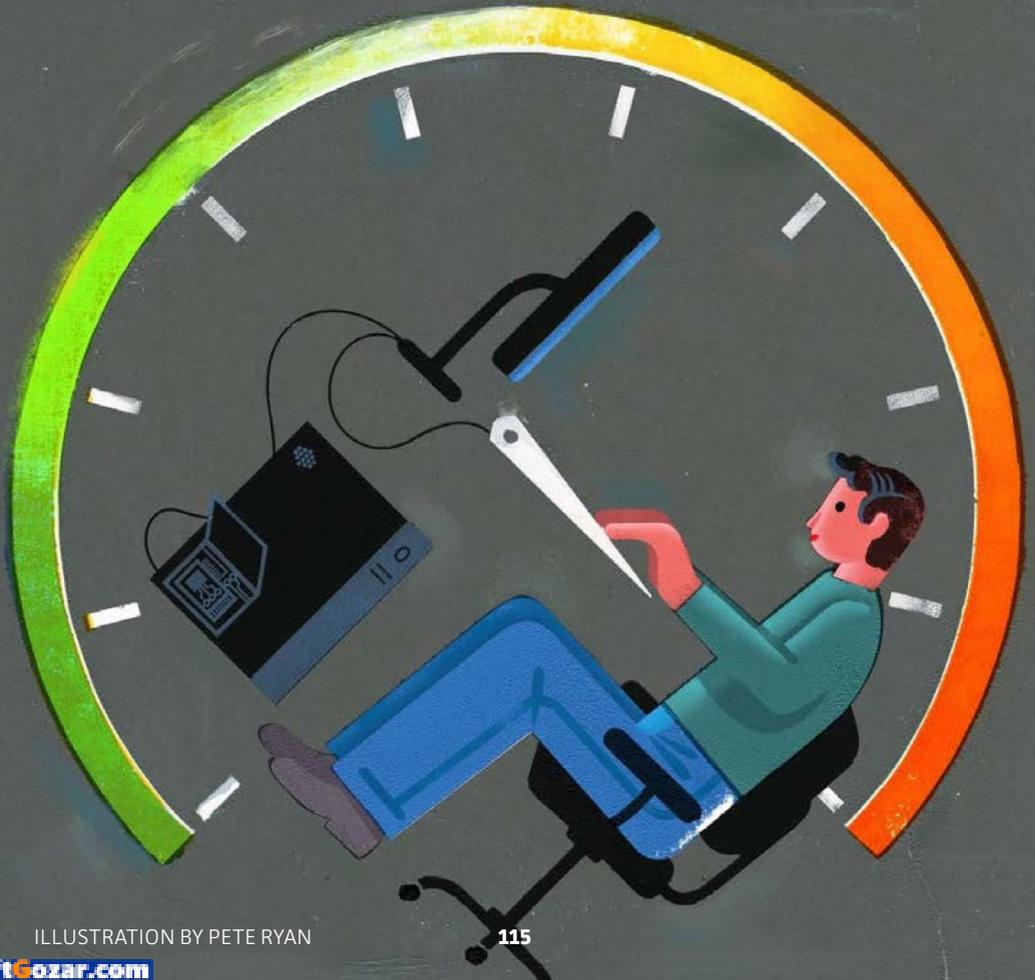Stand Up To Cancer Ambassador

Photo by Martin Schoeller

STAND UP TO CANCER

Ovarian Cancer Research Fund Alliance

n:O:CC
NATIONAL OVARIAN CANCER COALITION

STORAGE ON STEROIDS

Intel bets on PCIe SSDs, and Optane storage as fast as RAM. **BY GORDON MAH UNG**

I ntel's storage czar has a thing or two to say about the future of drive technology, naturally, but it's not all party line. *PCWorld* recently sat down with Bill Leszinske, who heads Intel's NVM (non-volatile memory) Solutions Group, to get his take on interfaces, hard drives versus solid-state drives, and when storage and RAM will merge.

SATA EXPRESS WHO?

Remember the SATA Express port? It arose in 2013, intended as an evolution of the slower SATA interface. While some systems began supporting the interface, however, drives for it never appeared—at least none we've ever seen. SSD performance also quickly eclipsed the capabilities of SATA Express.

SATA Express may never officially have been declared dead, but to Intel's drive division, at least, it is. "I'm not planning to offer SSDs in SATA Express," Leszinske said of the neglected interface. "I don't need another form factor or interface. It just complicates the product line."

Intel's 750 Series SSD is almost too fast for the latest interfaces.

Don't expect to ever plug an Intel SSD into that SATA Express port on your Z87 motherboard.

DIE, HARD DRIVE, DIE!

Much has also been predicted about when SSDs would supplant hard drives, but when you look at a $50, 1TB hard drive versus a $250, 1TB SSD, it doesn't seem like we're remotely close. Despite that gap, Leszinske said he believes an inflection point is imminent.

"There are some people who want large drives and will continue to buy them," Leszinske said. On the other hand, he pointed to research showing that the vast majority of people use less than 40 percent of their drive's capacity.

Hard drives will continue to be cheaper per GB than SSDs, but Leszinske thinks SSD prices will fall enough to convert more people. "When you can get a 256GB SSD that costs the same as a hard drive, call that $40-ish U.S. dollars, I think it's done."

Leszinske thinks many users will give up capacity for speed. "I think it just transitions because it's good enough storage, it's enough capacity," he said. "Are we within a year of that? Probably."

Leszinske admits his bias—"I'm an SSD guy"—but he's not far off-trend. A spot-check of prices on the Internet puts most name-brand 256GB SSDs in the $75 range, so $40-"ish" is within sight.

Even more aggressive is Leszinske's belief that SATA SSDs will soon be passe. He believes most consumers building or buying desktops will

soon move to PCIe-based drives. Leszinske predicted the price barrier would fall quickly. "As we head into the later parts of 2017, PCIe and SATA pricing get much closer," he said.

Performance plays a role, too. Today's SATA-based SSDs are limited to data throughput of 600Mbps. Moving to PCIe, M.2, or U.2 (formerly SFF-8639) removes the handcuffs and could quadruple that interface speed, or better.

Of course, Intel has a vested interest in this outcome. "Moving storage to PCIe in client and data centers helps keep larger amounts of data closer to the CPU, which means people get a better experience, which means they buy higher-end processors, which is good for Intel's overall business," Leszinske explained.

You can put your hard drive on ice pretty soon, Intel predicts.
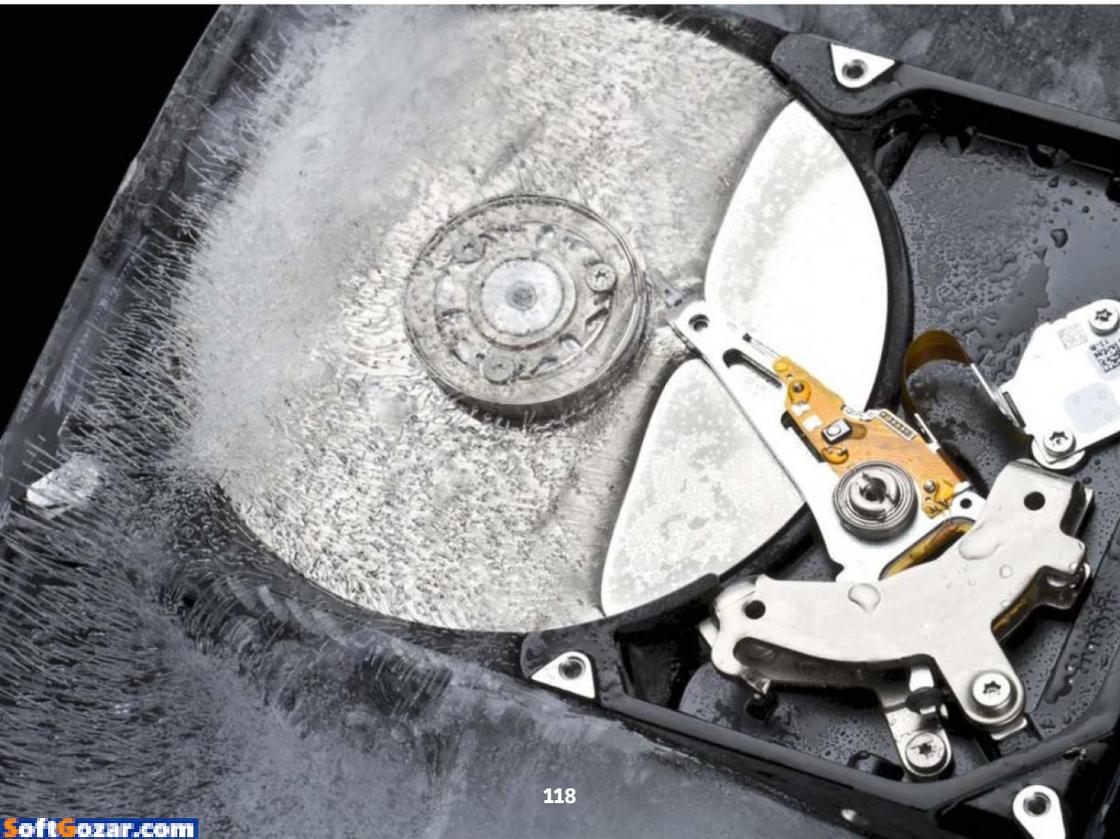
Intel's Optane technology promises "1,000 times" the gate performance of an SSD. But how will it work in your PC?
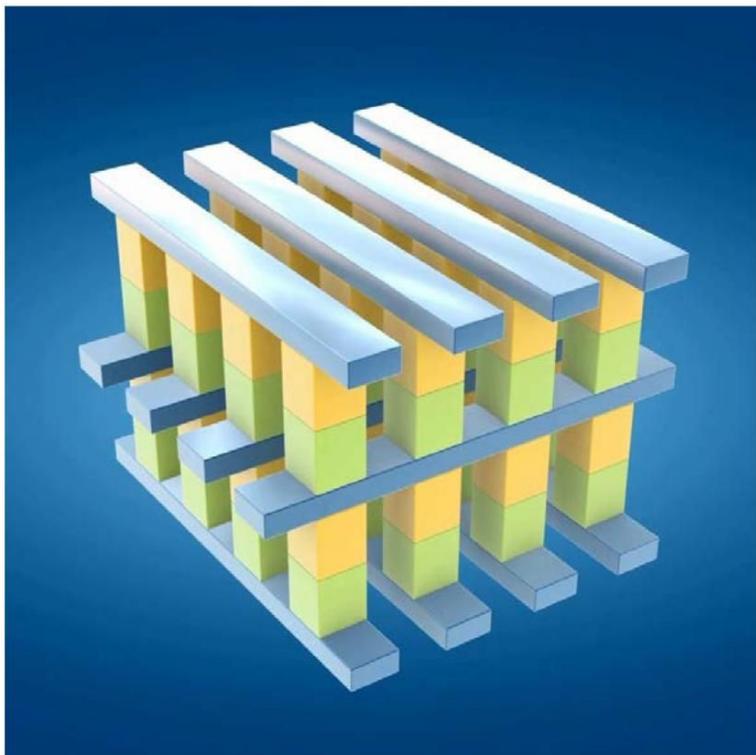
OPTANE WILL WORK WITH YOUR PC

Leszinske also outlined how Intel's Optane, or 3D XPoint, technology could be used when introduced. It's a little hard to wrap your brain around Optane, but it's essentially a storage device with gate performance that's 1,000 times faster (according to Intel and Micron) than today's NAND.

Leszinske dispelled rumors that users would be forced to buy new systems to run Optane—such as in purportedly leaked slides of Intel's upcoming Kaby Lake processor, which show "support for Optane." He said Optane drives will first be offered in PCIe, so pretty much anyone with a slot and system bandwidth to spare should be able to run it.

Perhaps more intriguing, though, is Optane in a DDR4 memory slot. Remember, Optane is "storage," but it's so fast that it approaches the speed of RAM. Intel even announced at IDF last year that it was planning to add extensions to an upcoming Xeon so it could directly work with Optane drives through a system's DDR4. That set off concerns (go.pcworld.com/iconcerns) in the industry that Intel was going to kick off another memory standards war.
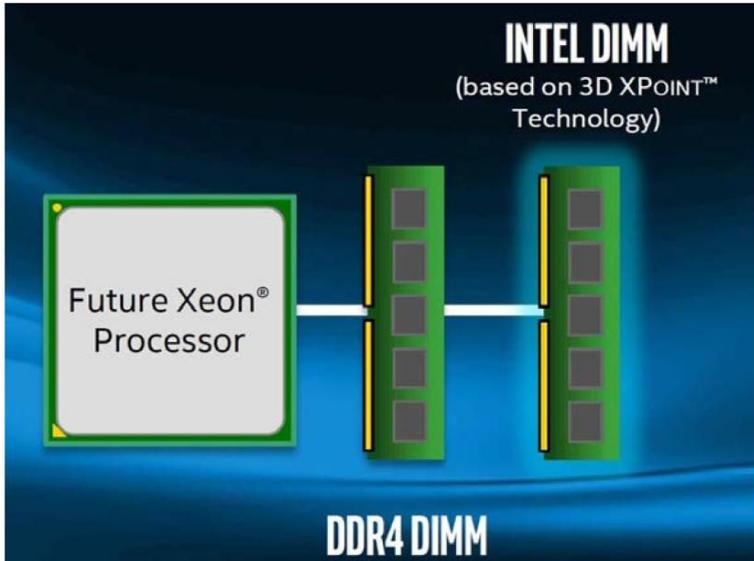
A future Xeon will support using an Optane device in a DDR4 memory slot.

While we didn't discuss the political battles, Leszinske did address why the CPU needs a change to work with Optane in a RAM slot. "We had to modify the DDR4 electrical interface because you have to be able to communicate that [the drive] is a persistent device versus existing things [e.g, RAM]," he said.

Leszinske added that it was no picnic to build in the new capabilities." It took a lot of work to build 3DXpoint. Build the controller, build the DIMM, modify the interface so that it knew it was persistent, to the memory controller in the CPU, to instructions that we had to add. It's been a multi-year process to get that going."

HPE's NVDIMM module has DRAM chips and multiplexors on the front, connected to NAND flash chips on the back.

Still, there is somewhat of a competing standard already in place called NVDIMM, or Non-Volatile DIMM—essentially persistent memory devices that don't lose data when power is cut off. HP Enterprise recently announced (go.pcworld.com/hpa) its first product with NVDIMMs.

Leszinke's preference wasn't a surprise. "I think NVDIMM will solve certain workloads, but they're not a great solution in the sense that it's usually a combo DRAM-plus-NAND thing," he said, continuing: "It's battery backed-up, which makes it expensive. It's not as, I'll call it, an elegant solution."

Even more interesting about Optane are the implications (go. pcworld.com/pcfuture) for the newfangled technology. Today, your PC might have 8GB or 16GB of memory. What if you had a 2TB or 4TB Optane device in a DDR4 slot that was 1,000 times the speed of an SSD?

Leszinske looked ahead to a time when storage and RAM would merge. "The fact that we have something called memory and the fact that we have something called storage is really an artifact of the technology," Leszinske said. "Ideally you'd just have a big pool of your stuff." It's still too soon to know how this more flexible vision of storage will affect future PCs, but Leszinske likely knows more than he was willing to say. "There's a lot of smart people doing a lot of re-imagining what a computer can look like." ⏻

"SURE, AT FIRST I WAS A LITTLE TAKEN ABACK BY THE WHOLE PEEING STANDING UP THING. BUT I TAUGHT HIM TO THROW A STICK AND NOW HANGING OUT WITH HIM IS THE BEST PART OF MY DAY."

—EINSTEIN
adopted 12-09-10

A PERSON IS THE BEST THING TO HAPPEN TO A SHELTER PET

adopt

theshelterpetproject.org

HERE'S HOW

CONTENTS

Word tutorial: Clean up a messy document's formats and styles using macros

Macros let you fix widespread formatting problems with one click.

BY JD SARTAIN

WORD MACROS CAN take almost any repetitive word-processing task and do it for you faster, in just a few keystrokes.

Here's a classic example: You've received a document with incorrect formatting throughout. You know what to do—use Search & Replace to fix them all—but doing that manually would be tedious for a short

document, and insane for a longer document. Here's how to program macros to fix them all for you.

Note: It's always best to create several smaller macros that perform a single function than one large macro that does it all. The primary reason for this practice is troubleshooting: If the macro fails, it's much easier to locate and repair a single error than to debug a longer, more complicated macro.

Macro basics: Name and assign keys

Recording a macro is just like recording a song: You get ready to perform the task, you hit Record; you perform the task, then you hit Stop.

In Word, you record macros from the Developer tab. To set up the Developer tab, click File > Options > Customize Ribbon. In the Customize The Ribbon column on the right side, confirm Main Tabs is selected in the drop-down menu. Click the Developer checkbox below.

1. Select the Developer tab, then click Record Macro. Enter a macro name in the Macro Name field box. For our example, we'll use **CleanUp1**.
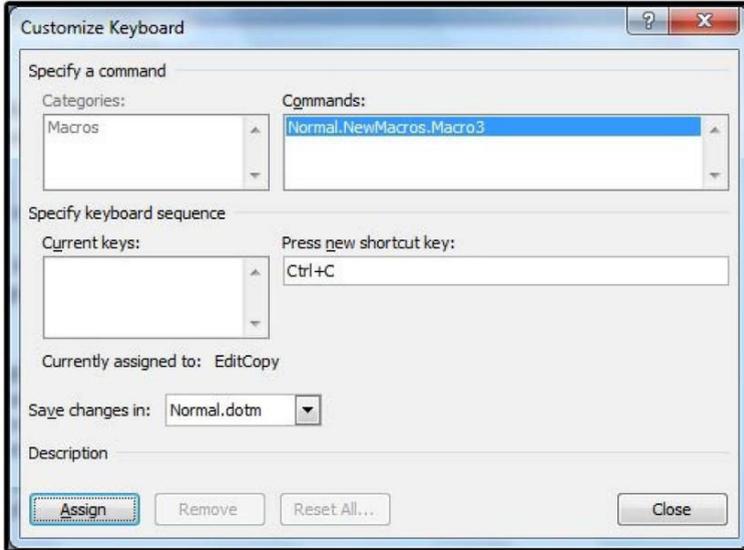
2. Under Assign Macro To,

WOODWARD   English
Surname means "ward of the wood" or "guardian of the wood".

WOTON   English
From Old English wadu-tun meaning "farm in or near a wood".

WORTHAM   English
Place name in Suffolk, England meaning "enclosed homestead".

WRAGGE   English
Old Danish given name   Wraghi.

WRAY   English
Various places in northern England, from Old Norse meaning "corner, recess". Denoted someone who hailed from any of the various places of that name in northern England, from Old Norse vrá.

WRIGHT   English
A nickname for an upright   person from Old French droit meaning "right".

WYATT   English
From the medieval given name WYOT.

WYGHT   English
Means "agile, strong", from Middle English "Wiht", Wigt. Also spelled Wight, Wite, and the more familiar White.

WYNDHAM   English
Mean "home that belongs to Winda", combined with Old English ham meaning "home".

Before: a messy, unformatted Word document
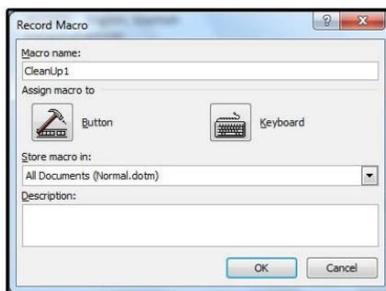
Use this dialog box to initiate the recording of a macro.

click the Keyboard button.

3. The Customize Keyboard dialog box appears. Under Specify Keyboard Sequence, click in the Press New Shortcut Key field, and enter a custom shortcut for this macro—a combination of Ctrl, Alt, or Shift and a keyboard character.

Most of the keyboard keys are already assigned to Microsoft Word's internal macros, such as Ctrl+X for cut or Ctrl+V for paste. The Currently Assigned To line in the dialog box tells you whether the key combination is taken. If you can't find enough unassigned keys, reassign one from a shortcut you never use.

4. For this example, enter the

Here's how to set up the macro using an unassigned combination of keys.

following custom shortcut: Ctrl+ | (pipe, the vertical-line character above the backslash character on most keyboards). Note that this combination keystroke is not currently assigned. Click the Assign button, then click Close.

After you've assigned the key, Word returns you to the document screen. You'll notice the macro recording buttons in the menu ribbon are active (that is, no longer grayed-out). Continue with the following instructions to finish recording this macro.
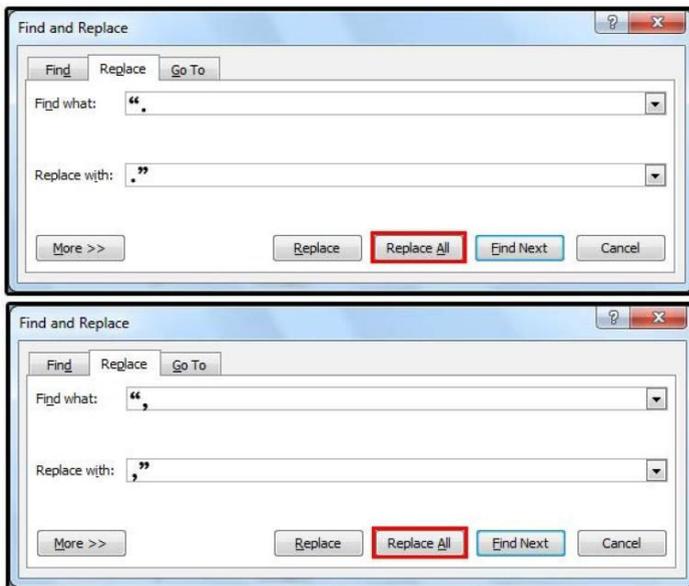
Recording macro CleanUp1: Quotation marks

This first macro moves the commas and periods from outside to inside the quotation marks, a punctuation rule specified by all published style guides including Associated Press, Chicago, Oxford, Webster's, and AMA.

Confirm you're in recording mode, then:

1. Press Ctrl+H to open the Find And Replace dialog box, and click the Replace tab. Place your cursor in the Find What field and type **".** followed by the Tab key, which moves you to the Replace With field. In

that box, type **."** and click Replace All, then OK.

3. You'll find yourself back in the Find What field. Starting from there, repeat the same process for commas outside of quotation marks.

4. Close the dialog box using the red button at the top right corner, then click the Stop Recording button in the macro menu ribbon.

Recording macro CleanUp2: Extra spaces

This macro removes all the extra spaces between words throughout the document. The process uses wildcard characters, which we'll explain in more detail in another column. For now, get a taste of their power with the following directions.

1. Select the Developer tab, click Record Macro, then enter a macro name: **CleanUp2**. Click the Keyboard button. In the Press New Shortcut Key text box, enter a custom shortcut for this macro: Ctrl+Shift+ Num + (press and hold Ctrl and Shift, press the + sign on the numeric keypad, then release all three keys simultaneously). Click the Assign button, then click Close.

2. Press Ctrl+H to access the Find And Replace dialog box. When the box appears, click the More button to display
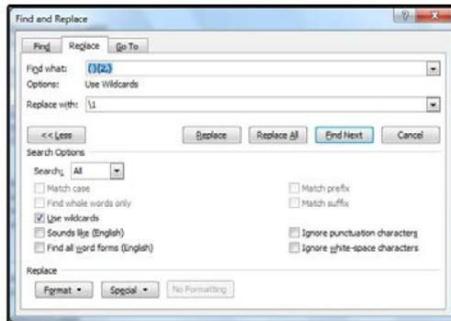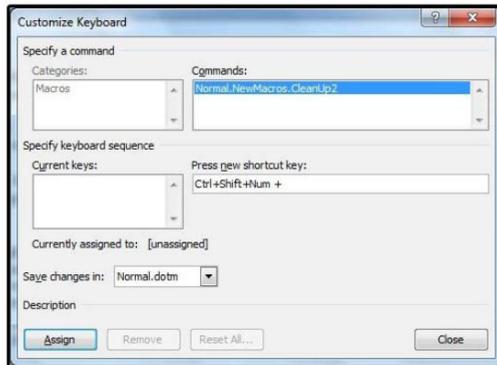
additional search options and special features. Under Search Options, click the Use Wildcards checkbox.

3. Next, enter the following keystrokes in the Find What and Replace With field boxes.

Find What: **( ){2,}**

Replace With: **\1**

4. Close the dialog box using the red button at the top right corner, then click the Stop Recording button.

If you'd like to test your macro, select Undo (or click the Undo button on the Quick Access Toolbar; then rerun your macro—that is, press Ctrl+Shift+Num + (simultaneously).
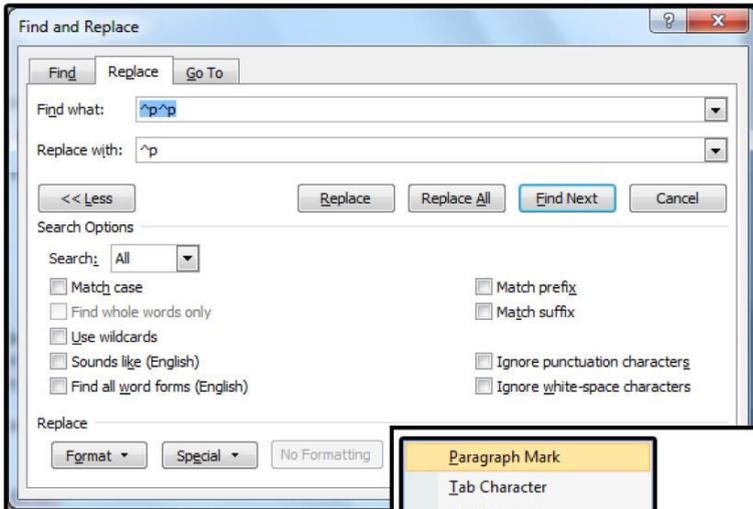

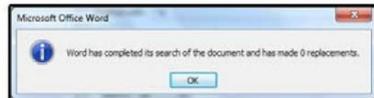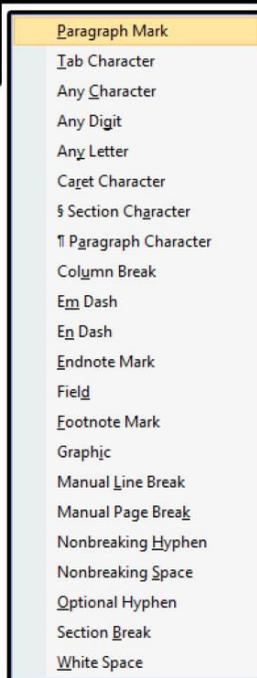## Recording CleanUp3: Remove line breaks

This macro removes all the extra line breaks throughout the document.

1. Select the Developer tab, click Record Macro, then enter a macro name: **CleanUp3**. Click the Keyboard button. In the text box under Press New Shortcut Key, enter a custom shortcut for this macro: Ctrl+Shift+Num – (press and hold Ctrl and Shift, then press the minus sign on the numeric keypad, then release all three keys simultaneously). Click the Assign button, then click Close.

2. Press Ctrl+H to access the Find And Replace dialog box. When the

Find and Replace

Find | Replace | Go To

Find what: `^p^p`

Replace with: `^p`

<< Less   Replace   Replace All   Find Next   Cancel

Search Options

Search: All

☐ Match case
☐ Find whole words only
☐ Use wildcards
☐ Sounds like (English)
☐ Find all word forms (English)

☐ Match prefix
☐ Match suffix

☐ Ignore punctuation characters
☐ Ignore white-space characters

Replace

Format ▾   Special ▾   No Formatting

Paragraph Mark
Tab Character
Any Character
Any Digit
Any Letter
Caret Character
§ Section Character
¶ Paragraph Character
Column Break
Em Dash
En Dash
Endnote Mark
Field
Footnote Mark
Graphic
Manual Line Break
Manual Page Break
Nonbreaking Hyphen
Nonbreaking Space
Optional Hyphen
Section Break
White Space

box appears, click the More button to display additional search options and special features.

Microsoft Office Word

Word has completed its search of the document and has made 0 replacements.

OK

3. Place your cursor in the Find What field, then click the Special button. Select Paragraph Mark, then select it again, resulting in two paragraph marks in the field box

Place your cursor in the Replace With text box, then click the Special button. Select Paragraph Mark just once.

Note: You can also enter the paragraph mark yourself as the code **^p**
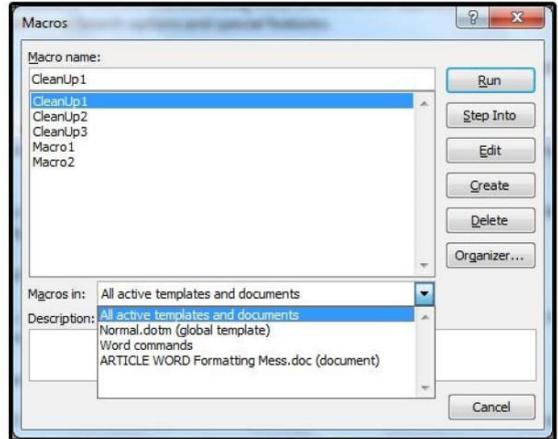
(using the caret symbol above the number 6).

4. Click the Replace All button, then click OK repeatedly until the popup dialog says "Word has completed its search of the document and has made 0 replacements."

Note: In this macro, I repeated this process three times. In most cases, that's probably enough; however, if not, just run the macro again.

Saving your macros

When you save your macro, the Macros In drop-down menu will let you select where and when you want them to be available in Word. The default is All Active Templates And Documents, and that works for most people. You can vary this macro to macro, of course.

And here's your reward: the finished, clean formatted document. Now you can try macros for other frequent tasks—feel free to experiment and find new ways to lighten your workload!

Most people will want to save macros so they'll be available for All Active Templates And Documents.
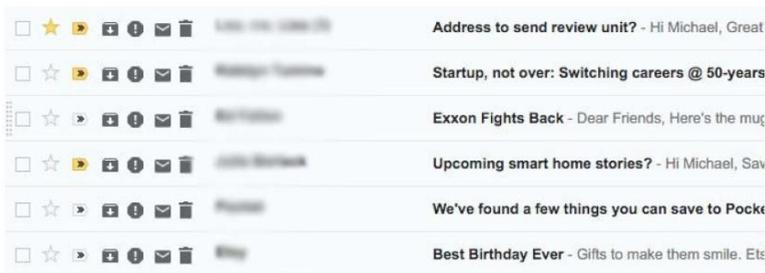
5 Chrome extensions that fill Gmail's gaps

BY MICHAEL ANSALDO

WHILE GMAIL DELIGHTS in any browser, it's particularly powerful when used in Google Chrome thanks to the wealth of extensions (go.pcworld.com/gmailchrome) that expand its capabilities. Here we look at a few add-ons that fill some holes in Gmail's functionality and help keep your inbox under control.

Actions for Gmail

Gmail's interface requires you to select or open a message before you

can perform any action on it. That doesn't sound like much of a hassle, but repeated over and over it can quickly eat away time better spent on more productive tasks.
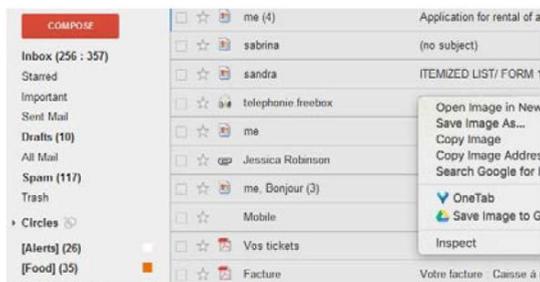
The simple Actions for Gmail (go.pcworld.com/gmailactions) extension lets you add up to four buttons—Archive, Delete, Mark As Spam, or Mark As Read/Unread—next to each message in your inbox, so you can process it with just one click. The result is a quicker path to inbox zero.

Attachment Icons for Gmail

That paperclip icon to the right of your email message lets you know you have an

Attachment Icons for Gmail transforms the paperclip into easy-to-identify icons for various file types.

attachment, but it doesn't tell you what kind. That means you have to open each message to see what file is attached, even if you don't want to deal with that file right then.

Attachment Icons for Gmail (go.pcworld.com/gmailattach) transforms the paperclip into a file-specific icon so you know at a glance what you've been sent. Now you can identity attachments as you scroll through your inbox and open only the ones you want to download immediately. Supported file formats include PDF, ZIP, and Microsoft Word, among others.

Checker Plus for Gmail

This popular extension (go.pcworld.com/checkerplus) lets you manage your messages without ever opening Gmail. It resides in your browser as a small button with an unread message counter. Click it for a drop-down window that lets you preview new email, including sender image and the first line of text. You can open, mark as read, or delete messages right from the Checker Plus interface.
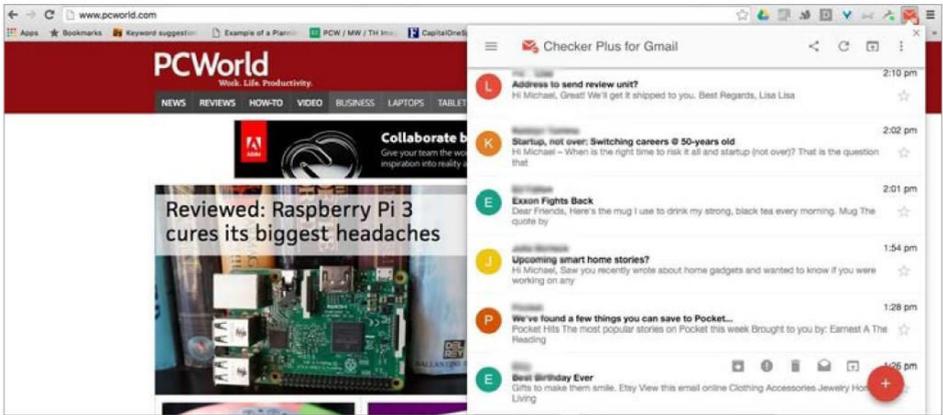
Just in case you're too busy browsing to notice the message counter climbing, Checker Plus also includes desktop notifications via pop-up windows, sound alerts, or voice notifications.

Checker Plus lets you manage your messages without opening Gmail.

Secure Mail for Gmail

If you frequently send sensitive material via Gmail, the Secure Mail for Gmail (go. pcworld.com/ securemail) extension is a

Secure Mail ensures only a message's recipient can decrypt the contents.

must. It encrypts and decrypts your messages so that only the intended viewer sees the text. All you have to do is click the lock icon Secure Mail adds next to Gmail's compose button and write your message and append it with a password. To decrypt the message, your recipient will also need the Secure Mail extension and the password

KeyRocket for Gmail

Gmail has a ton of keyboard shortcuts for speeding up your productivity. But remembering them all is tough and looking them up each time you need one just slows you down.

KeyRocket for Gmail (go.pcworld.com/keyrocket) teaches you the shortcuts by tracking your moves and suggesting key-combos for each mouse-and-click action. Use it regularly, and you'll be a keystroke king in no time. ⏻

Why Windows 10 wants your feedback and diagnostics, and how to control them

BY MARK HACHMAN

WE NOW KNOW the trade-off for free Windows 10: Microsoft wants data about what you do with your device. But you don't have to send everything you do back to Redmond.

You can control the data you send back, and how often, by delving into Windows 10's privacy settings, we've taken you here (go.pcworld. com/win10privacy) before, and looking specifically at Feedback Frequency and Diagnostic And Usage Data settings. The former is
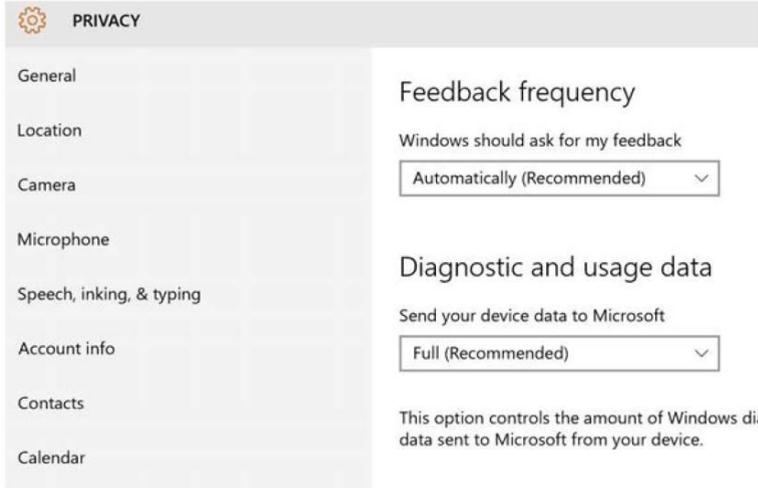
Set limits on what Microsoft sees with these feedback and diagnostic settings.

typically just an automated survey, but the diagnostic component actually peers into your machine.

These features comprised the Customer Experience Improvement Program, or CEIP, in previous versions of Windows—and they were voluntary. In Windows 10 they've become mandatory, but you can control some aspects.

Start by going to Settings > Privacy > Feedback & Diagnostics in Windows 10.

Changing the Feedback frequency

Every so often, Microsoft gets curious: Did you like this new version of an app?
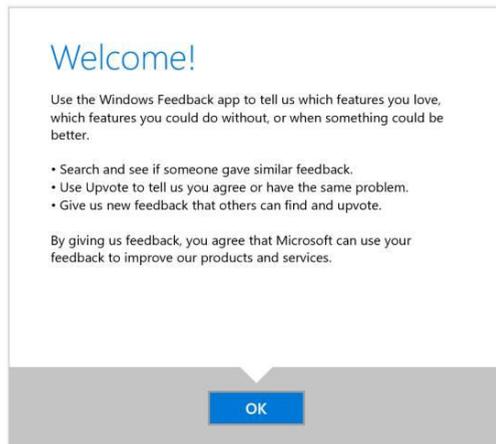
If you don't want to wait for Microsoft to ask you for your opinion, you can change the Feedback setting to your liking.

Would you recommend Windows 10 to a friend? Microsoft typically asks these sorts of questions of Insiders who've signed up to test Microsoft's beta software, but regular Windows 10 users may be quizzed as well.

Solicitations for feedback are infrequent. In fact, if you leave the Feedback Frequency setting at Automatic, you'll rarely see a pop-up. But you may set Feedback to Never if you never want to receive the prompts.

If, on the other hands, you can't wait to tell Microsoft what you really think, you can adjust the setting to Once A Week, or Once A Day, or even Always, so that presumably anything Microsoft has a question about will be flagged for your attention. You can also go to Start > Windows Feedback and use that app to send feedback on a specific issue.

What's collected for diagnostic and usage data

The diagnostic and usage data that Microsoft wants to collect, however, is much more intrusive. Microsoft won't know who you are by name, but it does track your device using a unique ID.

"As you use Windows, we collect diagnostic and usage data that helps us identify and troubleshoot problems, improve our products and services, and provide you with personalized experiences," Microsoft explains (go.pcworld.com/win10data) in a FAQ. "This data is transmitted to Microsoft and stored with one or more unique identifiers that can help us recognize an individual user on an individual device and understand the device's service issues and use patterns."

Here's the bad news: You

Part of what Microsoft collects includes the driver information governing your devices.
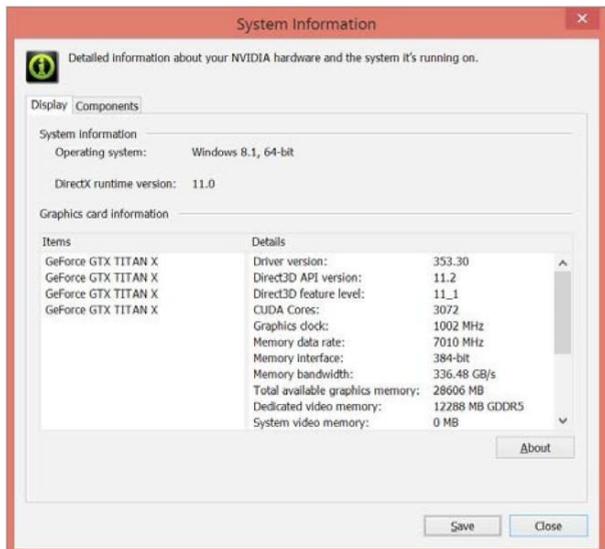
can't turn off diagnostic data in the Settings menu. By default, it's set to Full, which sends pretty much everything; however, you do have two dialed-back choices called Basic and Enhanced.

The Basic data setting collects the configuration data of your device (device name and model, as well as the hardware and software, including third-party apps and drivers); performance data, including how quickly programs respond to input; network data, including details of the networks you connect to and what radios you're using; and details of other hardware that's connected to your device.

Enhanced adds the ability to log "how frequently or how long you use certain features or apps, which apps and features you use most often, how often you use Windows Help and Support, and which services you use to sign into apps," according to Microsoft. It will also report the memory state of an app when it

> Microsoft doesn't even anonymize any personal data it collects via its Full diagnostics; it simply won't use that data for any sales purposes.

crashes, helping Microsoft improve the Windows 10 experience. Microsoft warns that it may collect parts of a document stored in that memory data.

Finally, the Full setting peers even deeper into your PC, but only in certain cases. When devices experience problems that are difficult to diagnose or replicate with Microsoft's internal testing, Microsoft will randomly select a small number of devices set to the Full level that are also exhibiting the problem, and gather all of the data needed to diagnose and fix the problem. (Note that if you're a Windows Insider, your Diagnostic setting is automatically set to Full.)

Microsoft doesn't even anonymize any personal data it collects via its Full diagnostics; it simply won't use that data for any sales purposes. "If an error report contains personal data, we won't use that information to identify, contact, or target advertising to you," Microsoft says.

The data may also travel further than you'd like. Microsoft says its own employees use it, but the company also shares the data with third-party affiliates and hardware partners where relevant. ⏻

7 ways to keep your dying Android phone or iPhone alive

BY BEN PATTERSON

SO THERE YOU are, running from meeting to meeting on a particularly busy day when you suddenly notice your iPhone or Android phone's battery gauge is deep in the red. It's too late for sensible battery-conservation tips—you need power for your dying handset now, or at least a way to staunch the bleeding.

We've gathered seven tips that'll help preserve the last precious drops of juice in your phone's battery, as well as ways to find emergency sources of power while you're on the road.

1. Turn your handset off and then on again

It's one thing if your phone's battery is dying simply because you've been using it all day without a break. But if you're watching your battery gauge drop 5 or even 10 percent in a matter of minutes,

Doing a hard reset on your phone is a good way to stop an app with a battery-draining memory leak.

something's up. Most likely, one of your apps or even a core Android or iOS process has spun itself into a furious, battery-draining loop.

One of the best ways to pull your phone out of its death spiral is a hard reboot—that is, forcing your handset to stop absolutely everything it's doing and restart.

You can do a hard reboot on an iPhone or iPad by pressing and holding the power and sleep-wake buttons until the Apple logo appears.

The method of performing a hard reboot on an Android phone depends on the make and model of your handset. For most Android devices, you can press and hold the power and volume-down buttons for a hard reboot. Or, if your Android handset has a removable battery, try taking it out and putting it back in. Still no luck? Check your device's documentation or go Google it.

2. Look for a battery-hogging app

If your phone's battery life is still tanking after a hard reboot, you could always try to pinpoint an app that's draining more than its fair share of power.

For Android, tap Settings > Battery, then scroll down and check out the list of apps. If you see one that's been using a lot of juice lately, tap

it and tap the Force Stop button to stop it in its tracks.

For iOS, tap Settings > Battery, then look for a culprit in the Battery Usage list. If you spot any battery hogs, you can close the app by flicking up its "card" in the app switcher (double-tap the Home key), or cut off its background activity privileges (tap Settings > General > Background App Refresh, find the app in the list, then flip off its switch).

Both Android phones and iPhones have tools that'll help you spot a battery-hogging app.

3. Turn on Airplane Mode

Another possible reason for a plunging battery gauge is that you're in an area with poor cellular service. When that happens, your phone will keep trying (and trying and trying) to establish a connection, and that's a sure way to drain your battery in a hurry.

You can turn Wi-Fi back on once you enable airplane mode on your Android or iOS device.

If that's the case, your best bet may be to turn on Airplane Mode. Doing so will turn off your handset's cellular radio and stop it from frantically looking for a cellular signal.

For iOS devices, tap Settings, then switch on the Airplane Mode setting, or just flick up the Control Center window and tap the **Airplane Mode** button. For Android devices, pull down the Quick Settings window shade and tap the Airplane Mode button.

If you don't like the idea of being out of touch, keep in mind that you can always turn on Wi-Fi after activating Airplane Mode.

Turning on Android's Battery Saver mode or iOS's Low Power Mode is a good way to conserve the last precious drops of juice on your handset.

4. Turn on battery-saver mode

Both Android and iOS devices boast a battery-saver setting that'll shut down most background activities, dim the screen, and enable other battery-preserving features, handy if you're suddenly dealing with a phone that's almost out of juice.

For Android devices, tap Settings > Battery, tap the three-dot overflow button in the top corner of the screen, tap Battery Saver, then flip on the switch. While you're at it, make sure to enable the Turn On Automatically setting, which activates battery-saver mode when your device's battery life falls below either 15 percent or 5 percent.

On an iPhone or iPad, tap Settings > Battery, then enable the Low Power Mode setting; you'll also be prompted to turn the feature on if your device falls below 20 percent or 10 percent of battery life remaining. Unlike Android's Battery Saver feature, iOS's Low Power Mode setting can only be activated manually.

Some phone-charging cables are small enough to fit on a keychain.

5. Carry an extra phone charger

Everyone wants a phone charger when their handset is about to run out of juice; the real trick, of course, is making sure you have one on hand when you need it.

Go ahead and spring for an extra phone charger, preferably a small, lightweight model, or even a cable that's small enough to clip to a keychain. Once you've got an extra cable, make sure to keep it in your backpack, purse, or briefcase at all times.

The next time your phone is running low on battery life, all you'll need to find is an available power outlet or USB port and some charging time. Thanks to the fast-charging technology built into the newest Android and iOS handsets, you'll only need about 10 minutes or so to get a decent chunk of battery life back.

6. Get a portable battery pack

Even a phone charger won't do you much good if you're nowhere near a power outlet. In those cases, having a portable battery pack stashed in your knapsack, your pocket, or hooked to your key ring can be a lifesaver.

Many different shapes and sizes of portable battery packs are available; some are as big as hardback books, others are credit-card sized. Price tags range anywhere from about $20 to north of $100, depending on the size of the charger.

Another option is a phone case that doubles as a charger, although such battery-charging cases will add extra weight and girth to your handset, while those designed for a specific handset won't do you much good if you trade up for a different model.

Check out (go.pcworld.com/choosecharger) for mobile charger shopping tips.

7. Find a charging station

No spare charger or portable battery pack? Well, you could always try the kindness of strangers, or there's another option: tracking down a mobile charging station.

You won't find a free charging station on every street corner, but

The best phone-charging kiosks offer lockers that you can secure with a credit card.

they often pop up in hotel lobbies, airport terminals, fast-food joints, drug stores, and even department stores.

The best mobile charging stations offer tiny lockers that you can secure with a credit card; just lock your phone in the charging station, go have a cheeseburger, and come back to a charged (or mostly charged) handset.

There are only a couple Android and iOS apps that'll help you find free charging stations, unfortunately, and those that exist typically only locate specific charging station brands; Brightbox (Android version: go.pcworld.com/brightboxandroid, iOS app: go.pcworld.com/chargeitispotandroid) is one, ChargeItSpot (Android version: go.pcworld.com/chargeitispotandroid, iOS version: go.pcworld.com/chargeitispotios) is another. ⏻
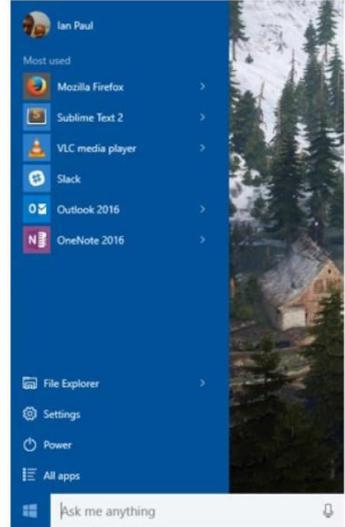
How to remove Live Tiles from the Windows 10 Start menu

AN EASY WAY to divide a room of Windows 10 fans is to start debating the merits of the tiles section in the new Start menu (go.pcworld.com/win10start). Some people love it, others don't. Personally, I think Live Tiles on a PC can be helpful for quick hits of information like the weather, news headlines, and stock prices.

That said, lately I've been playing around with a tiles-free version of the Start menu. It's very minimalist and forces me to make some hard choices about what I put on the taskbar. That's because when you give up the Live Tiles section, you have almost zero control over the rest of the Start menu. Nevertheless, right now I'm finding it useful and you might too.

It's that easy

Open the Start menu, right-click a tile and select Unpin From Start. Now do that for every single tile on the right side of the Start menu. As you get rid of the tiles, the named sections will start to disappear until there's nothing left. Once all the tiles have been removed, close the Start menu by clicking another spot on your desktop. Then open the Start menu again and you should see something similar to what's pictured at right.

That's all there is to it. You now have a kind of a modernized take on the Windows 95 and 98 Start menu.

The downsides

The good part of adjusting the Start menu this way is that you remove the Live Tiles and end up with something much simpler. The downside is you can't adjust the left side (now the only side) of the Start menu.

What I found when I did this is that the Most Used section of the Start menu is actually useful. Most of the programs I use every day are there. I'm not sure if that's because Windows 10 adjusts what it puts there in the absence of the tiles section. Or it was always this useful and I simply ignored it. Whatever the reason, you may find that a lot of the apps and programs you use every day are available to you under this section.

If not, you do have a few choices: You can accept that you'll have to dip into the All Apps screen in the Start menu, or you can pin a few programs to the taskbar.

If none of that works, you can also look at using third-party options such as ClassicShell and Start10 (go.pcworld.com/nolivetiles).

What I don't know, however, is whether this slimmed down Start menu will survive a major Windows update. It could be that Microsoft will stuff the Start menu again later this summer with the Anniversary Update (go.pcworld.com/win10anniupdate). If it does, at least it won't be that hard to go back to a simpler version. ⏻

The Start menu without the tiles section in Windows 10.

How to recover a hijacked Facebook and keep it safe

Your Facebook account tells a lot about you and your social circle. You need to keep control of it.

Martin Anisko fell for a phishing attack, and a hacker succeeded in taking over his Facebook account.

If a crook succeeds in stealing your Facebook account, they can masquerade as you, find out a good deal about you, and get access to your friends.

If the email address and/or password on your account has changed—and you didn't change it—your account has been hacked. Other possible symptoms that should worry you include new "friends"

that you never approved, and status updates and messages allegedly going out from "you" even though you didn't send them.

The following instructions assume that you're accessing Facebook from a full, desktop-oriented browser rather than a mobile browser or app.

First, try to change your Facebook password:

1. Click the little white triangle near the upper right corner on the Facebook webpage and select Settings.

2. This brings you to the Settings page's General tab. Click Password.

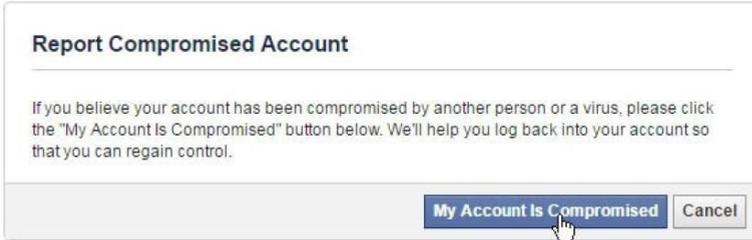3. Enter your current password in the Current field.
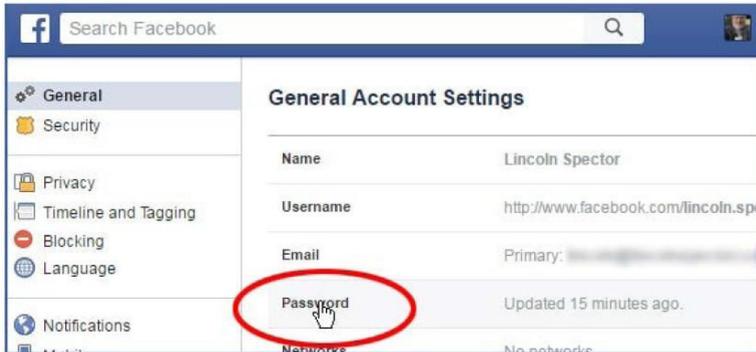
4. Type a strong password (go.pcworld.com/4passwmanagers)in the New and Re-type New fields. This should be a password you've never used before. I strongly suggest you use a password manager.
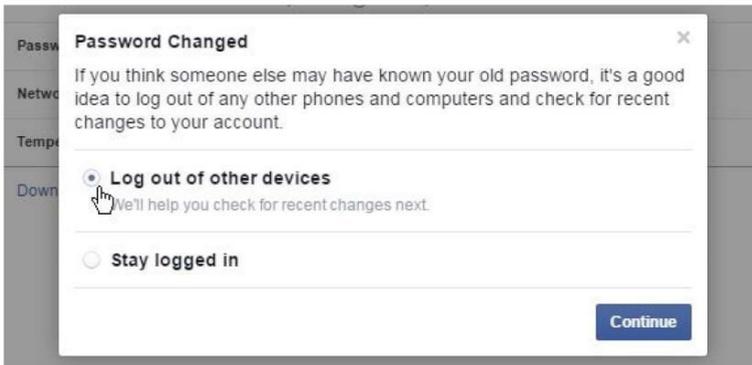
When you click Save Changes, Facebook may reject your current password. If it does, whoever hacked your account has already changed it.
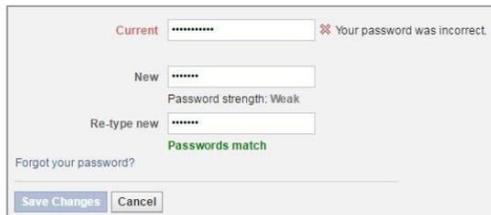
Go to Facebook's Report Compromised Account (facebook.com/hacked) page, click the My Account Is Compromised button, and follow the wizard instructions.

Report Compromised Account

If you believe your account has been compromised by another person or a virus, please click the "My Account Is Compromised" button below. We'll help you log back into your account so that you can regain control.

My Account Is Compromised   Cancel

But if Facebook accepts the old password (and the new one, of course), you can sigh with relief. You've recovered your account. Facebook will ask if you want it to log off of other devices; take them up on that offer.

Password Changed   ×

If you think someone else may have known your old password, it's a good idea to log out of any other phones and computers and check for recent changes to your account.

⦿ **Log out of other devices**
  We'll help you check for recent changes next.

◯ **Stay logged in**

                                              Continue

Once you've got your Facebook account pages, take some steps to make sure this never happens again:

Back on the Settings page, click the Security tab on the left, then click Login Approvals (also known as 2-step verification). Check the Require A Security Code To Access My Account From Unknown Browsers option. If you haven't given Facebook your cell number, you'll have to enter it here.

Once you've set up Login Approvals, enable Login Alerts. That way, Facebook will notify you via email if your account is accessed by a browser, app, or device that has never accessed your account before. If you didn't do the logging in, you'll know you have a problem. ⏻

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Android Showdown:
LG G5 vs. Samsung Galaxy S7

» If you're looking for the latest premium Android phone, you're likely
choosing between the recently launched Samsung Galaxy S7 or the
LG G5. Our Android expert Florence Ion compares them for you.