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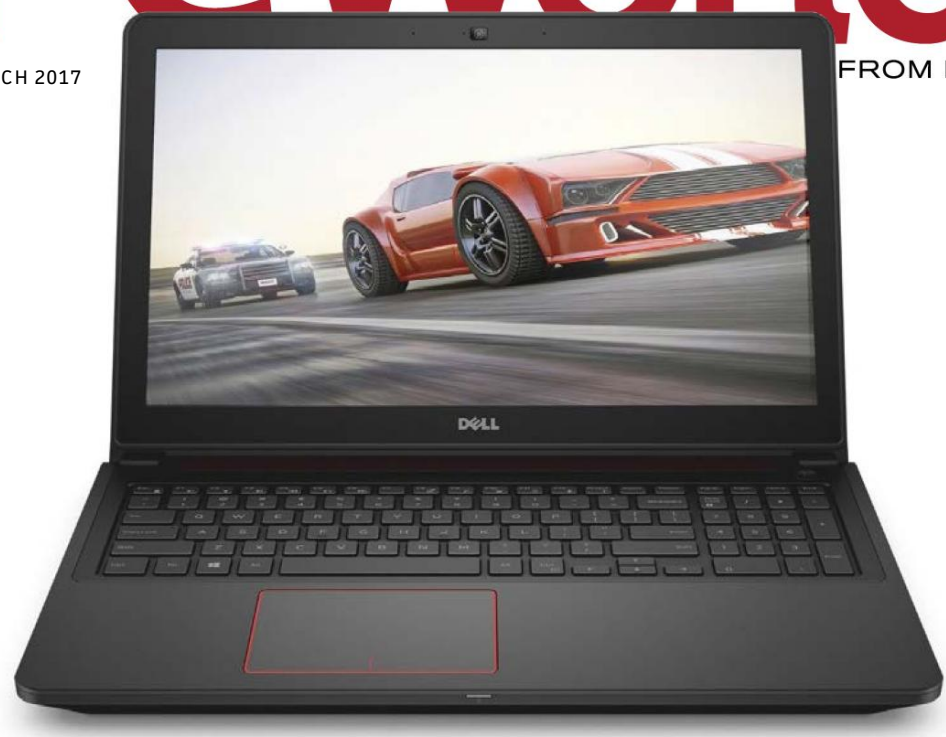

WINDOWS 10

Creators Update

What to expect from the new OS

INSIDE:

If we show you how to back up your PC for free, will you finally do it?

Photo By: Peggy Sirota

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MAKE BREAKFAST HAPPEN SO KIDS CAN BE HUNGRY FOR MORE

Photo By: Peggy Sirota

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

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NEWS

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WHAT THIS PLACE NEEDS IS ACTIVE PLAY EVERY DAY.

Thanks to our work with NFL PLAY 60, we've brought fun fitness programs to more than 35,000 kids. And it can happen here too.

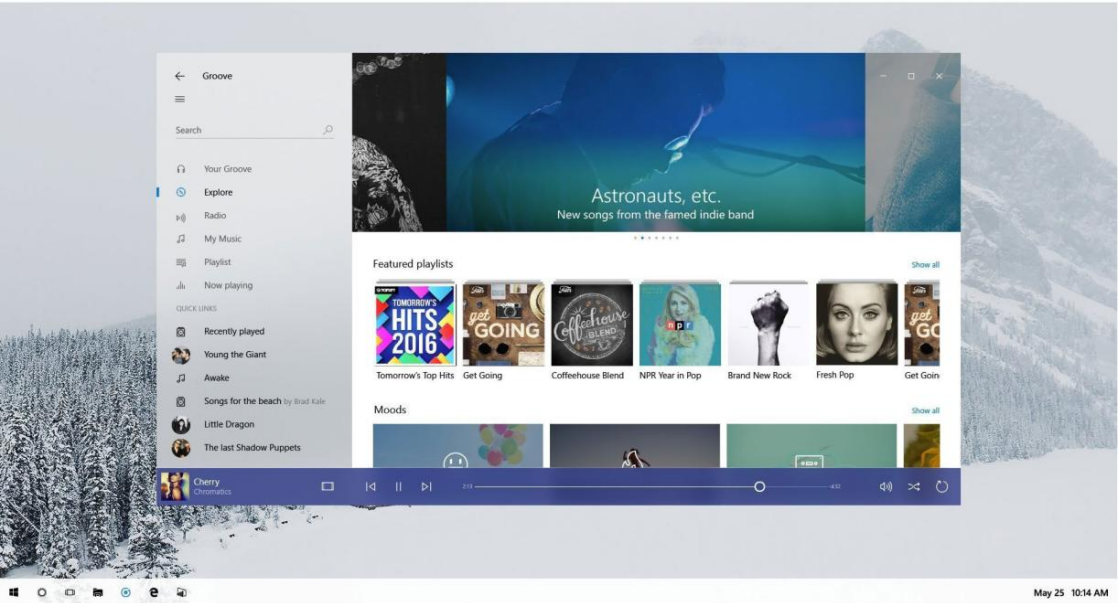
Microsoft teases Windows 10's sleek new look for the future

BY IAN PAUL

MICROSOFT IS PLANNING a sleek visual refresh for Windows 10, and the company quietly teased its first official glimpse of what's coming in the future during the Windows Developer Day keynote (go.pcworld.com/winkynt) in February.

There aren't many details being shared about "Project Neon" right now—as the refresh was called in earlier leaks (go.pcworld.com/neonlk)—but the new visual look will focus on animations and transitions. The basic concept is "to add fluidity, animation, and blur to apps and the operating system," as first reported by Windows Central (go.pcworld.com/neonpeek). The new design language also hopes to make it easier for developers to create attractive apps.

The design refresh should extend to all Windows 10 devices including PCs and tablets, HoloLens, Xbox, and the few surviving Windows



Microsoft's first official look at Project Neon.

Phones (go.pcworld.com/winphn), according to Windows Central.

Twitter user Tom Hounsell (go.pcworld.com/thtweet) shared a clean version of Microsoft's first look at Windows 10's forthcoming design tweaks. The image shown on the livestream had large text overlaid on top of the screenshot.

As you can see, this isn't a huge change, but the visual refresh gives Windows 10 a sleeker, more modern feel. The taskbar icons look a little more dynamic and bolder. Cortana (go.pcworld.com/win10twk) is using the icon instead of the search box, though it's not clear if this will be the default look. The clock on the taskbar is also bolder, and the usual notification area icons including the Action Center are notably absent. The open Groove Music window itself looks more polished and Aero-esque as well, with no title bar to be seen—just unobtrusive options in the app's upper-right corner.

The impact on you at home: Windows Central says that some of the code for Project Neon is already available in recent Insider Preview builds of Windows 10; however, it's unlikely the visual refresh will be ready in time for the massive Creators Update (go.pcworld.com/win-10up) this spring. Microsoft is expected to share more information about Neon during the Build conference in May. The Creators Update is expected to roll out in late March (go.pcworld.com/win10mar) or early April, followed by a second major update later in 2017.

IMAGE: TOM HOUNSELL

Windows 10's Creators Update bug bash begins

BY MARK HACHMAN

ON FEBRUARY 3, Microsoft announced the launch of its "bug bash" for the Windows 10 Creators Update, a sign that it's beginning to slowly wind down its development process before it finally releases the next major version of Windows.

Historically, Microsoft begins each iteration of its milestone Windows 10 releases by fixing a few last-minute bugs from the previous version. It then begins rolling out and testing all the new features (go.pcworld.

com/win10up16) of the upcoming milestone to Windows Insiders in the preview program (go.pcworld.com/w10pre).

At some point, though, Microsoft moves into the last phase of its development process, fixing all of the bugs that Microsoft employees and its Windows Insider beta testers discover in the imminent release. That phase typically begins with a huge bug-fixing exercise, known as the "bug bash," which in this case ran through February 12. Microsoft uses the information it gathers to determine which bugs are the most serious and prevalent, so it can prioritize which to fix first.

Microsoft hasn't said when the Creators Update will actually ship; it's still due in "early 2017." The blog post (go.pcworld.com/w10bugb) announcing the bug bash notes that Microsoft developers will be working on fixing these bugs for the next "several weeks," however, meaning that our guess that the Creators Update could be released at the end of March is still valid.

Why this matters: Most users know on some level that adding a new software feature introduces new bugs to go along with it. The annual bug bash/bug-fixing phase is critical, however, to help shape the public's opinion. Not every bug will be found or eliminated before the software's release. The idea is to at least prevent headline-grabbing

glitches such as those that disabled webcams (go.pcworld.com/w10cams) in the Anniversary Update.

How the Windows 10 CU bug bash works

Any motivation to assist Microsoft in its bug bash is primarily a charitable one, with the end goal of simply improving Windows. Nevertheless, Microsoft offered special Bug Bash badges for the Feedback Hub as prizes for those who participated.

Any motivation to assist Microsoft in its bug bash is primarily a charitable one, with the end goal of simply improving Windows.

Insiders checked the Windows 10 Feedback Hub for new "Quests," tasks that Microsoft would like beta testers to perform to check for bugs. Leaving feedback within the Hub was also encouraged. Insiders had to make sure they were running the latest Windows 10 preview at the time, Insider Build 15025 (go.pcworld.com/w1015025), which included a feedback mechanism that consolidated similar reports into a single response.

Microsoft also held live webcasts with engineers on February 7 to walk users through some of the quests, which Microsoft said would change over the course of the week.

As always, Insiders should test out Windows 10 on a secondary PC. Stumbling across bugs that can break or force you to reset your PC is part of the Insider experience. Cruising on an Insider machine, though, can also be an awful lot of fun.

Windows 10 Creators Update could ship March 31, and we're already worried about bugs

BY MARK HACHMAN

MICROSOFT HASN'T OFFICIALLY committed to a ship date for Windows 10's Creators Update, but evidence suggests it could reach Insiders as soon as the end of March. Given how the last major Windows 10 update went, however, we're feeling equal parts eagerness—and caution.

So far, all Microsoft has promised for the Creators Update is that it will ship in "early 2017." Two tantalizing clues suggest a more specific date: Both Microsoft's Surface Studio PC and Dell's Canvas monitor offer features closely tied to the Creators Update, and both now list shipping dates at the end of March. It's no stretch to suppose that

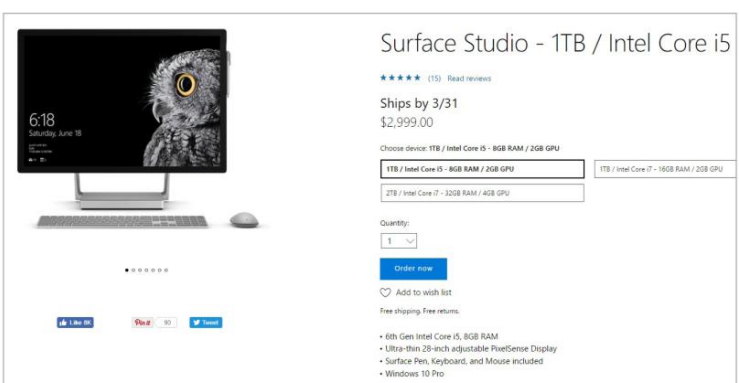
both companies would align those releases with the Creators Update, and Dell has said as much already.

Our caution stems from what happened when Windows 10's Anniversary Update launched last August (go.pcworld.com/w10rev). A swarm of bugs came with it, including a login freeze (go.pcworld.com/w10frz), as well as a more serious issue that crashed webcams (go.pcworld.com/w10cams). Third-party security firms, like McAfee, warned that their products might not be compatible (go.pcworld.com/w10bugs2). Consumers and businesses certainly don't want a repeat.

Why this matters: Microsoft undoubtedly has pressure to push the Creators Update out the door to ensure that work on the other major Windows 10 update this year—Redstone 3—begins in time to meet holiday deadlines. We're going to lay out the case that Microsoft could ship the Creators Update in two months' time—but maybe it shouldn't be in such a rush.

The clues to the timetable

Several clues point to an end-of-March release for the Creators Update. For starters, there's the update cycle. When Microsoft has



The two lower-end models of the Surface Studio are scheduled to ship by the end of March, while the high-end Core i7 part will ship by the end of June, according to this Store page.

Dell's Canvas monitor looks remarkably like the Surface Studio; there's even a Surface Dial clone called the Totem to go with it.

prepared major Windows 10 updates in the past, the company has fixed bugs in one release, then unveiled features to its Insider testers in the next. The last few weeks before a major Windows 10 update, Microsoft launches few, if any further features, focusing instead on bug-bashing. Finally, Microsoft sends the update release to Insiders, rolling it out to the greater public a week or two later.

The company's recently delivered a series of builds to Insiders. One of them, Build 15002 (go.pcworld.com/w10p15002), offers a particularly heavy bag of goodies. More is coming: When it ships, the Creators Update promises a host of new capabilities (go.pcworld.com/w10up), including 3D imaging support and a much-anticipated Games Mode.

And then there are the Creators Update's touch input innovations, which help set apart Microsoft's Surface Studio and Dell's Canvas from other Windows hardware. The sophisticated stylus controls, and especially the moveable menu-navigation device that Microsoft calls the Surface Dial and Dell calls the Totem, offer new ways for people to interact with their software. Neither product is complete without these features enabled by the Creators Update.

It's very unusual for different companies to ship similar products on more or less the same day unless there's a concerted effort, such as timing to the release of a product they have in common. That's why the coincidence of Microsoft's Surface Studio and Dell's Canvas seems

to point to something bigger afoot with Windows 10.

While technically the Surface Studio began shipping last fall, Microsoft currently shows March 31 as the "ships by" date for the two lower-end versions of the PC (priced at $2,999 and $3,499). A day earlier on March 30, Dell will ship Canvas, a Studio-like tilting monitor (go.pcworld.com/dellcanv, $1,799) that you can use with a separate PC.

Dell has also told *PCWorld* that the Creators Update will be in place by the time the Canvas ships on March 30. "Since the device isn't available until 3/30—all of the features of the Creators Update will be available when Canvas ships," a Dell representative said in an email recently. (She declined to comment on the exact timing of the Creators Update in a follow-up inquiry.)

Waiting for Redstone

Time is not on Microsoft's side. The company has already said that it plans two updates (go.pcworld.com/w10up2) in 2017: the current Redstone 2 release (the Creators Update), and its successor, Redstone 3. The latter is the problem: PC makers are undoubtedly depending upon Redstone 3 to help drive holiday PC sales. Delay the Creators Update too long, and Redstone 3's development window will shrink to the point where Microsoft will have to sacrifice something. We're already past the sixth month of the Creators Update's development cycle. Shipping it sometime in April or May would allow a scant six months to develop Redstone 3 by October or early November.

Shipping it sometime in April or May would allow a scant six months to develop Redstone 3 by October or early November.

Microsoft does have one thing going for it: Aside from the Surface Studio and Dell Canvas, there's no indication that other PC vendors will be aligning a new generation of PC hardware around the Creators Update. However, Windows 10's Creators Update is the first to include the Windows 10 Holographic Shell, which will power a series of head-

The Windows 10 Anniversary Update included a bug that killed webcams, which made many people unhappy until it was fixed.

mounted displays (go.pcworld.com/winvrhdst) from Acer, Asus, Dell, and more. Delaying the Creators Update wouldn't tank the PC market, but it would disappoint a legion of hardware makers with some VR equipment to sell.

Even so, Microsoft could still afford an extra week or two to ensure everything goes smoothly. If anything, Surface buyers know that the first (or third!) revisions of the hardware often ship with their own set of bugs (go.pcworld.com/surfbugs).

If that's the debate within Redmond, here's what we'd say to Microsoft: Suck it up and get it right. Maybe the only exciting thing about 2017's holiday PCs will be Intel's Optane (go.pcworld.com/optane) and AMD's Ryzen chips (go.pcworld.com/ryzen). That's enough. As for Microsoft, let Project Scorpio (go.pcworld.com/prjscorpio) be the product that gets shoppers into stores.

Microsoft aimed high with Windows 10, but buggy updates have damaged the operating system's reputation. That can and should change. Courage isn't removing a headphone jack. Courage is sitting down in front of upset customers and admitting that Microsoft didn't deliver a product whose quality is worthy of its name—but this time, it will.

Additional reporting by Melissa Riofrio

A Windows Cloud build leaked, and this is what we learned

BY IAN PAUL

MICROSOFT'S MYSTERIOUS WINDOWS Cloud (go.pcworld.com/wincloud) is supposedly a stripped-down version of Microsoft's operating system that runs only Windows Store apps. Microsoft's not commenting, but an early build that leaked in early February appears to be authentic and gives further tantalizing hints of what the company may have in mind.

It only runs Windows Store apps, but…

The idea behind running Windows Store apps only is that a Windows Cloud machine can be more easily managed, like a Chromebook. If you remove Win32 (traditional desktop) apps, you get greater security and control because users can only turn to web apps or the Windows Store.

But this might not be the whole truth behind Windows Cloud. Brad Sams at Thurrott.com ran the leaked build of Cloud on an x86-based virtual machine. (You'd be crazy to run a leaked build on bare metal, so it's understandable to see him run it in a VM.)

If you remove Win32 (traditional desktop) apps, you get greater security and control because users can only turn to web apps or the Windows Store.

Regardless, it's clear that Windows Cloud (at least right now) can run on x86 processors. If that holds true for the official release, then there's no reason it couldn't run Win32 apps save for an artificial limitation put there by Microsoft.

Interestingly, MSPowerUser (go.pcworld.com/w10cld) said it was able to download, but not run, Win32 apps that were in the Windows Store via Project Centennial (go.pcworld.com/projcent).

There's an upgrade path to Windows 10 Pro

Writing at Petri.com (the parent site to Thurrott.com), the same Brad Sams discovered there's an upgrade path built into the leaked build to go from Windows Cloud to Windows 10 Pro. That further supports the notion that Cloud will appear on at least some x86 hardware. It's also possible there could be upgrades to other versions of Windows in an official release.

If Windows Cloud offers upgrades, then this is a serious mashup of the ghosts of Windows past—the second coming of Windows RT plus Windows Starter Edition (go.pcworld.com/winstarter). Windows Starter Editions were versions of Windows from XP to 7 that were stripped down and simplified for netbooks (sound familiar?). They also

included an upgrade path to Windows Home or other versions via the Windows Anytime Upgrade.

The odd thing is that if Windows Cloud is supposed to be a Chromebook competitor, why the upgrade path? Moving to Windows 10 Home or Pro defeats the point of a simplified operating system that is easier to manage. Plus, doesn't this suggest Microsoft will advertise upgrades (go.pcworld.com/w10moreads) to Windows Cloud users? Yuck.

A Windows Store–only PC also is locked into Microsoft's Edge browser, which lacks the popularity of Google's Chrome browser, with its vast extensions and app catalog. That's like bringing a wet sponge to a gun fight.

Can the Windows Store take on Google Play?

This last point is more of a general question about Windows Cloud than anything we've learned from the leaks. A Windows Cloud machine has to rely on the anemic Windows Store. Meanwhile, its competitor Chromebooks, which were struggling to accumulate Chrome native apps, are about to gain a huge advantage. Google recently confirmed that all Chromebooks from 2017 and beyond (go.pcworld.com/chrmandrd) will be able to run Android apps via the Play Store.

If there's one thing Microsoft hates, it's watching another company make gains in the space it dominates: PCs.

Microsoft might have an advantage with productivity features like digital inking and possibly Cortana, but as we've seen before when it comes down to apps, the better store always wins.

Why this matters: If there's one thing Microsoft hates, it's watching another company make gains in the space it dominates: PCs. For that reason, the company needs to dislodge Google's dominant foothold in the education market with its Chromebooks. But Chromebooks started as minimally capable computers and have added features over time. It's hard to say whether people will be any more accepting of a pared-down Windows than they were before.

Intel demotes PCs, giving datacenter chips first crack at new technologies

BY MARK HACHMAN

WITH INTEL'S FORECASTS projecting the PC could be the smallest moneymaker five years from now, the company has gone "data center first"—giving Intel's server business first crack at new manufacturing technologies.

It's another sign of massive change within Intel, as the traditional PC business is shoved to the side. In a slide presented during Intel's investor day, the company showed off how the total available market (TAM) for its PC CPU business was just $30 billion or so, less than half

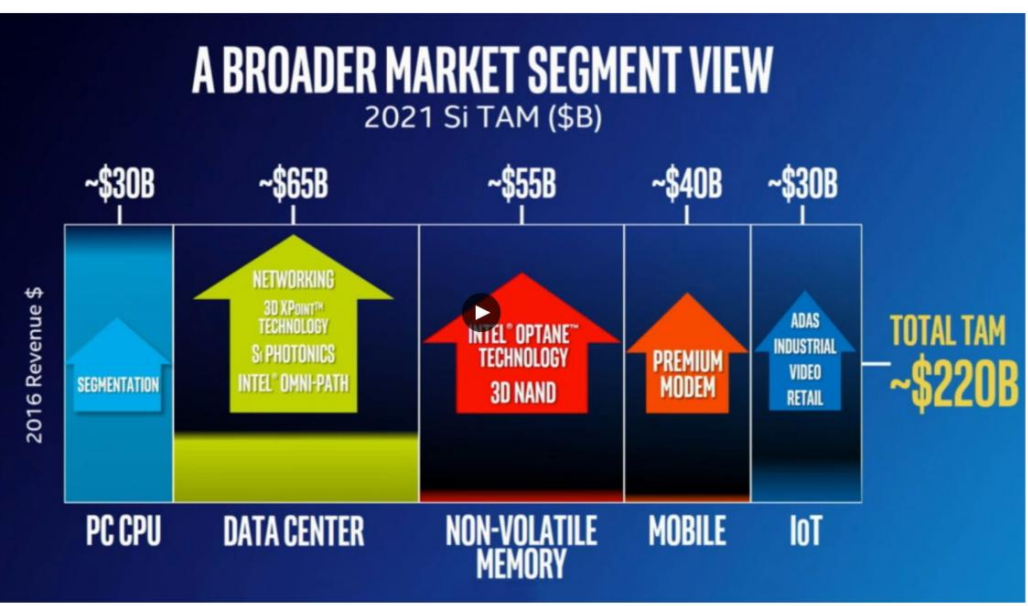
that of the data center.

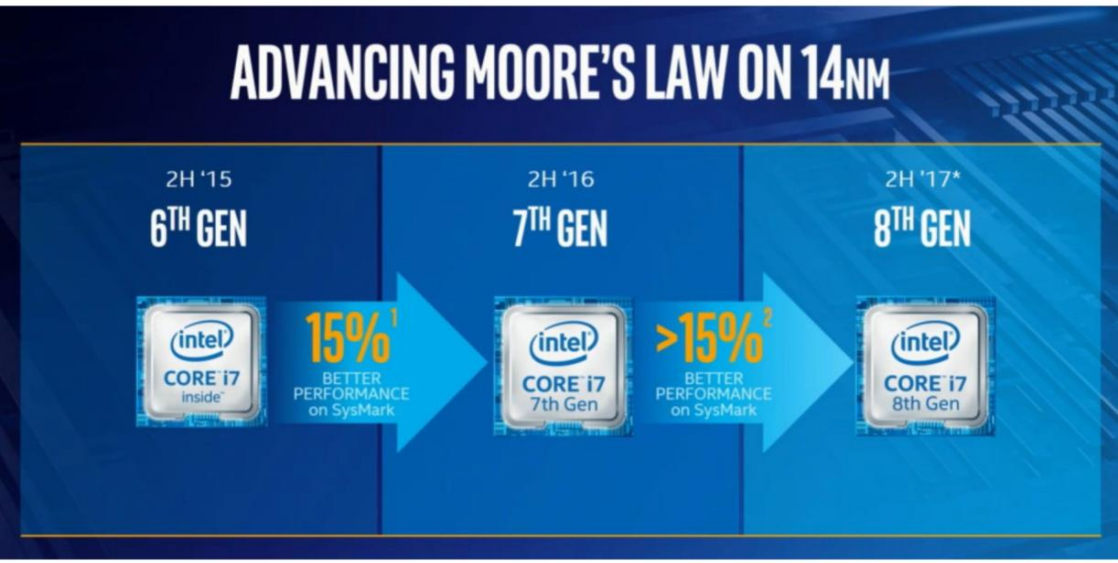
The TAM, as its known, projects the maximum available revenue Intel could pull in if it owned the entire market—which won't happen. It's an excellent guide to which segments Intel is prioritizing, however: the data center, non-volatile memory like flash and its new Optane, plus mobile communications and various embedded segments.

Historically, if Intel jumped ahead to a new manufacturing technology, its PC chips would get first crack. Now, Intel's premium fab lines are reserved for the Xeon and other chips being shipped to cloud providers and the data center. "It's a big deal," according to Intel's data center chief, Diane Bryant.

What this means: This is Intel putting its money where its mouth is. Venkata Renduchintala, president of the Intel Client and Internet of Things businesses and Systems Architecture Group, spoke glowingly during the investor day event of how the PC business grew revenue as PC shipments declined. (Shortly before this event, Kim Stevenson, who was second-in-command, left after six months on the job.) But the

Intel clearly sees opportunities in anything else but PCs.





cloud and the chips that power them are headed in the opposite direction: up. It may be unfair to characterize funding the PC business as throwing good money after bad, but that's a bit of what's going on here.

Intel's road map toward Cannonlake looks like business as usual.

Intel's priorities: the cloud, not the PC

"2016 was probably the biggest year of transition in Intel's history," Intel's chief executive Brian Krzanich said in introducing the company's investor day, which familiarizes Wall Street with the various components of Intel's businesses.

Intel used to be a fairly simple company: It manufactured chips for the laptop PC, the desktop, as well as for servers. Today, its core microprocessor business is complemented by forays into memory, networking, the Internet of Things, wireless communications, even software. "All of the things we do either produce or require large amounts of data," Krzanich said.

Intel's always had a strong interest in the server market, and a quick look at Intel's price list shows why: Desktop Core chips command $300

or so apiece (go.pcworld.com/core300), while a single Xeon chip for servers can be priced up to almost $9,000 (go.pcworld.com/xeon9k).

That's paid off in the "data center first" strategy. As part of Krzanich's restructuring, "each of the functional groups inside of Intel look at their business and their investments and their strategies, in the context of making the data center a priority," Bryant said. "And that includes being first to launch on a next-generation process technology node, and that's a big deal."

For what Bryant called the upcoming "10-nm+" node, as well as the 7-nm manufacturing node to follow, Intel's data center chips will be first on those lines. Historically, it simply wasn't possible for the Xeon to be first onto the new technology, as Intel couldn't ship enough chips to justify the cost. The massive size of Xeon chips also meant a higher risk, as the inevitable manufacturing defects of a new process could ruin the finished product. Now, with a modular packaging structure in place, Intel can afford to shift to its "data center first" strategy, she said.

Cannonlake will offer the usual improvements

That doesn't mean the PC is dead, but it isn't commanding the lion's share of attention at Intel anymore.

Renduchintala opened his presentation by essentially bragging that Intel had raised its operating profits by 30 percent as the PC market declined. Part of that, he said, was thanks to fat-margin Core i7 chips, which hit an all-time high in percentage of Intel's total CPU sales. Renduchintala said he expected that trend to continue. Intel has previously identified virtual reality as a key driver (go.pcworld.com/vrdriver) for the industry, and in one VRMark benchmark, the company found that VR performance improved by 36 percent when moving from a Core i3 to a Core i7.

That doesn't mean the PC is dead, but it isn't commanding the lion's share of attention at Intel anymore.

Intel's 2017 priorities look beyond the PC, too.

Renduchintala didn't offer much in the way of a PC road map, but he did confirm that Intel's upcoming Cannonlake chips will deliver a performance improvement of more than 15 percent (go.pcworld.com/clakefast) compared to its Kaby Lake chips, based on the Sysmark benchmark.

Unfortunately, Intel also failed to provide a road map for its Optane product, which Intel has said could revolutionize the PC by serving as a lightning-quick source of local storage. Rob Crooke, Intel's memory chief, said Intel was already working on its first three generations of its Optane technology, and it's apparently shipping to data center customers. But there was no word on pricing for PC customers.

Kraznich, though, spoke glowingly of Optane's desktop future. "Every single gamer is going to want 3D Xpoint," the technology underlying Optane, he said. "Every single gamer."

Meet the Corsair One, Corsair's 'category-defying' gaming PC debut

BY BRAD CHACOS

CORSAIR'S WELL KNOWN for its wide array of enthusiast-focused PC cases, memory, liquid CPU coolers, and even liquid-cooled graphics cards. The company's hardware powers many parts of *PCWorld*'s own graphics card test system. But now, after finding its footing with the bare-bones Bulldog PC, Corsair is combining its vast array of

knowledge into its first-ever full-blown PC, dubbed Corsair One.

Corsair isn't shedding much light on the One just yet, unfortunately. There's a minimalistic webpage where you can sign up for more info, and an advertisement in *Maximum PC*'s March issue that describes it like this:

"Meet Corsair One, the category-defying new PC from the designers and builders at Corsair. The most trusted name in precision-engineered PC components brings you a machine built from the ground up to power anything and everything you love to do."

The story behind the story: That said, you can discern some clues about the Corsair One by studying the available materials. It's a relatively small form factor PC, as you can see from the image on the previous page, yet it's still powerful enough to apparently play the demanding *Witcher 3* on a widescreen display. That detail, paired with the HDMI and USB ports gracing the front of the computer, suggests Corsair's debut PC will be capable of playing virtual reality games as well. Who knows? Maybe it'll even pack Corsair's own liquid-cooled GeForce GTX 1080.

Corsair's also going to have to find a niche somewhere between the big-box companies like Dell and boutique PC builders who hang their hats on customization and customer support—but damn if I'm not intrigued by the Corsair One.

Corsair One's details

The case itself appears to blend Corsair's traditional "clean black box" chassis design with some of the more aggressive aesthetics of the relatively new Spec-Alpha lineup (go.pcworld.com/specalpha), though it leans toward a more subdued look overall. The Corsair One's diminutive size suggests it'll use mini-ITX parts rather than a full ATX motherboard. The perforated side panels and heavy fins at the top and bottom of the case hint that the PC will have plenty of air circulation to house powerful desktop components, however.

One thing missing? An optical drive. It shouldn't come as a surprise, as Corsair's cases have been dumping 5.25-inch drives in favor of a "Direct Airflow Path" design now that Steam and downloadable games have largely usurped physical discs.

Moving from an army of components and the bare-bones Bulldog is a major step for Corsair, both in the price it'll be able to charge and the amount of support it'll need to offer to customers. A whole lot more can go wrong in a fully assembled rig over singular pieces of hardware, after all. Corsair's also going to have to find a niche somewhere between the big-box companies like Dell and boutique PC builders who hang their hats on customization and customer support—but damn if I'm not intrigued by the Corsair One.

So when can you pick one up? Your guess is as good as mine. Corsair hasn't revealed pricing or release date information about the Corsair One either.

Watch the video at go.pcworld.com/hpspx360vid

HP's 15-inch Spectre x360 features upgraded hardware and a new look

BY ALAINA YEE

IN ANTICIPATION OF our coming review, we decided to haul HP's refreshed 15-inch Spectre x360 2-in-1 out of its box and compare it against last year's model.

Some updates you can't see, of course. All configurations now feature a Core i7 dual-core processor, discrete GPU (Nvidia's GTX 940MX), and a 79.2-watt-hour battery. The latter is a nice upgrade from the previous generation's 63WHr version. All models get a 4K UHD screen.

What you can see are a smaller footprint and narrower bezel, and a slight increase in thickness. The 2017 Spectre x360 15 also has lost two USB 3.0 Type-A ports and a mini-DisplayPort in favor of a single USB-C 5Gbps port. It's gained 4 ounces, though, for a total weight of 4.43 pounds.

The 2017 Spectre x360 15 also has lost two USB 3.0 Type-A ports and a mini-DisplayPort in favor of a single USB-C 5Gbps port.

As you might suspect, these updates raise the price of the base model, which still features 256GB of storage and 8GB of RAM. Previously, this line started at $1,150 for a full HD screen and Core i5 CPU with integrated graphics, but with the 4K screen and discrete graphics it now begins at $1,280.

That said, rival laptops with quad-core parts and a touchscreen (like the Dell XPS 15, go.pcworld.com/dellxps15) start at $1,600—so HP may keep its lock on consumers who want a premium, portable 15.6-inch laptop with good battery life at a reasonable price. We'll find out how this new hardware holds up soon enough.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The best consumer antivirus products of 2016 are Avira and Norton

AV-Test and AV-Comparatives have published their end-of-year awards for the best anti-malware products of 2016, selecting Symantec's Norton and Avira as the ones to buy.

BY MARK HACHMAN

THE TWO MAJOR independent antivirus testing houses have completed their assessments of the best antivirus products for 2016, and the results are in: Norton by Symantec came out on top in one test, and Avira in the other.

AV-Comparatives released its best anti-malware product of 2016, after AV-Test announced its choice in early February. There was the usual dash of controversy, however, as Symantec again declined to submit its Norton product to AV-Comparatives for testing.

Otherwise, the winners were clear: AV-Test anointed Norton Security

2016 as providing the best protection of all consumer anti-malware products it tested during 2016. AV-Comparatives named Avira Antivirus Pro 2016 as its best anti-malware product of 2016, narrowly edging out Bitdefender and Kaspersky.

Why this matters: No average user wants to venture into the dark recesses of the Web, let alone try to capture the malware that lurks there for product testing. Specialized testing houses do do this, however, with the idea that testing a PC's defenses is better done in the laboratory than on your machine. You certainly don't have to take the advice of AV-Test and AV-Comparatives as gospel. Factors like pricing and each program's usability aren't considered. But the findings give you a number of options from which to choose.

Though it selected Avira as Product of the Year, Bitdefender and Kaspersky Lab scored so highly that AV-Comparatives created a new category, Outstanding Products 2016, to honor the two.

AV-Comparatives breaks down the best solutions

The good news is that of the 19 antivirus vendors who submitted products to AV-Comparatives for testing, all were rated as Approved security products, capable of providing acceptable PC protection. That includes Microsoft's built-in, free Windows Defender, which AV-Comparatives and other vendors use as a baseline for comparing the other products.

Though it selected Avira as Product of the Year, Bitdefender and Kaspersky Lab scored so highly that AV-Comparatives created a new category, Outstanding Products 2016, to honor the two. Put simply, the agency believes that all three products supply the best protection for your PC. The firm also assigned a Top-rated Products award to those products that finished at or near the top of various categories: Emsisoft, ESET, Tencent, and ThreatTrack VIPRE.

In considering its awards, AV-Comparatives looked at five different

	File detection	Performance	Real-world protection	Malware removal	File detection	Performance	Real-world protection
	March 2016	May 2016	Feb-Jun 2016	Mar-Sept 2016	Sept 2016	Oct 2016	Jul-Nov 2016
Avira	★★★	★★★	★★★	★★★	★★★	★★★	★★★
Bitdefender	★★★	★★★	★★★	★★★	★★★	★★★	★★★
Kaspersky Lab	★★★	★★★	★★★	★★★	★★★	★★★	★★★
ThreatTrack	★★★	★★★	★★★	★★	★★★	★★	★★★
Tencent	★★★	★★	★★	★★★	★★★	★★★	★★★
ESET	★★★	★★★	★★	★★	★★	★★★	★★★
Emisoft	★★★	★★★	★★	★★	★★★	★★★	★★
F-Secure	★★★	★★★	★★	★★	★★★	★★	★★
Avast	★★	★★★	★★	★★	★★	★★★	★★★
AVG	★★	★★★	★★★	★★★	★	★★	★★★
QuickHeal	★★★	★★★	★	★★	★★★	★★★	★
Lavasoft	★★★	★★	★★	★★	★★★	★	★★★
eScan	★★★	★★★	★	★★	★★★	★★	★
BullGuard	★★★	★★★	★	★★	★★★	★★	★
Fortinet	★★	★★	★	★★	★★★	★★	★
McAfee	★★	★★	★		★★★	★★★	★
Trend Micro	★★	★	★★	★★	★★	★	★★
Sophos	*	★★	★	★★	★	★	★
Microsoft	★	★	★	★★	tested	★	★

AV-Comparatives' overall test results. One star indicates Standard (acceptable) results, with the other two representing Advanced and Advanced+ scores.

aspects of protection: detecting actual malware, as well as not flagging legitimate software as malware; removing the malware; and how much of an impact protection and removal had on your PC. The fifth test simply looked at how well each product did in the real world (using known malicious URLs), rather than a laboratory.

AV-Comparatives also broke down the winners by category, allowing you to parse which antivirus product to buy based upon what's important to you. We'd suggest the Real-world Protection Tests (go.

AV-Test.org's ratings for various anti-malware products under Windows 10. Note that you can drill down for more detailed findings within each product on AV-Test's site.

pcworld.com/rwtest), whose top award went to Bitdefender and its 99.9 percent malware block rate. Note, though, that other vendors do just as well in blocking malware—Trend Micro, for example, also blocked 99.9 percent of all tested malware samples. AV-Comparatives didn't rate it favorably, however, due to the relatively high number of false positives—legitimate software detected as malware. In that case, Trend Micro reported 67 false positives, while Bitdefender reported zero. Each of those 67 cases would have required your manual intervention to "whitelist" the innocent software.

Symantec snubs AV-Comparatives, again

That fact that Symantec was once again excluded from AV-Comparatives' testing isn't unusual. Since 2012, Symantec has refused to submit its code to AV-Comparatives. Though Symantec didn't offer *PCWorld* a statement by press time, the company told users in 2012 that AV-Comparatives didn't offer a test that evaluated Norton's real-world protection capabilities.

"Our philosophy is to participate in tests that have high relevance and meaning for consumers, and most accurately align with their real-world need for comprehensive protection and machine cleanup from evolving online threats," the company said then.

For its part, AV-Test highlighted the best products in various categories. AV-Test awarded Norton the crown with its Best Protection award for consumers, but singled out Kaspersky for its Best Performance award and Best Usability awards. Avira, however, was named as the Best Repair Software if your PC is already infected.

AV-test also published a more granular look at its findings (go.pcworld.com/rw2) on its website. In Windows 10, for example, the firm found that Avira, Bitdefender, Kaspersky, Quick Heal, and Trend Micro offered the best protection. The firm even tested anti-malware on older operating systems, including Windows 7 (go.pcworld.com/rw3).

With literally dozens of antivirus products to choose from, it can be a struggle to figure out which will actually secure your PC. It's also a moving target: Malware evolves, and so do the methods to combat it. But if you want to know what the best anti-malware software is out there *right now*, this is one of the few times that question can be answered pretty definitively.

If you've ever owned a PC with a DVD drive, you may get a $10 settlement

BY MARK HACHMAN

DVD DRIVES MAY be a thing of the past, but the past could pay you $10 via a proposed settlement from a class-action suit.

If you purchased a DVD-ROM, DVD-RW, or combination drive between April 2003 and December 31, 2008, a collection of DVD drive manufacturers have tentatively agreed to pay you $10 per drive, whether you purchased the drive as part of a PC or by itself. You'll simply need to visit the claim site (go.pcworld.com/dvdclaim) and testify (under penalty of perjury) that you indeed purchased those drives within the given time period, and live in one of the 23 states (plus the District of Columbia) covered by the suit. The deadline to file is July 1.

Why this matters: Though the optical-drive market continues to decrease—"the physical disk format is somewhat obsolete in the era

of content streaming," IDC wrote last year—that wasn't the case fourteen years ago, when virtually all software was distributed via DVD-ROM. Fortunately, the settlement site isn't asking for proof of purchase yet, but it reserves the right to do so. Filing a claim can take literally seconds, but don't hold your breath—you'll *probably* receive compensation, but there's no guarantee.

The wheels of justice turn slowly

Simply put, a group of 23 plaintiffs sued virtually every DVD drive manufacturer, alleging that they collectively conspired to keep drive prices higher than they normally would be, in violation of antitrust laws. Though the defendants denied they did anything wrong, several—Hitachi-LG, Panasonic, NEC, and Sony—settled and agreed to pay a collective total of $124.5 million into four separate settlement funds.

(Note that only DVD drives for PCs are covered; a DVD player, such as the one gathering dust in your living room, isn't.)

If you do submit a claim, however, the chances of receiving your settlement soon are slim. That's because seventeen more defendants, including various subsidiaries of BenQ, Philips, Samsung, TEAC, and Pioneer, have yet to settle, and the suit will continue until all of the claims are resolved.

"Because other defendants remain in this litigation, the plaintiffs are proposing that distribution of the settlement funds not occur at this time," the settlement site reads. "This is to save the expenses associated with distribution."

In fact, the settlement hearing to finally approve the Hitachi-LG-Panasonic-NEC-Sony agreement will be held on December 8. After that, payments may begin—which means that you'll probably receive your $10 or less a year from now. Yes, *less*: Payments will be "up to" $10 per drive, according to the claims site.

You should probably treat the settlement like one of those "print out your own rebate" slips from the turn of the century. Even under the best of circumstances, chances are you'll have totally forgotten about your $10 windfall by the time the check arrives.

Why Linux users should worry about malware and what they can do about it

BY ALEX CAMPBELL

PREVENTING THE SPREAD of malware and/or dealing with the consequences of infection are a fact of life when using computers. If you've migrated to Linux or Mac seeking refuge from the never-ending stream of threats that seems to target Windows, you can breath a lungful of fresh air—just don't let your guard down.

Though UNIX-like systems such as Mac OS X and Linux can claim fewer threats due to their smaller user bases, threats do still exist. Viruses can

be the least of your problem too. Ransomware, like the recent version of KillDisk, attacks your data and asks you to pay, well, a king's ransom to save your files. (In the case of KillDisk, go.pcworld.com/killdisc, even paying the ransom can't save you if you're running Linux.)

Keep your system updated

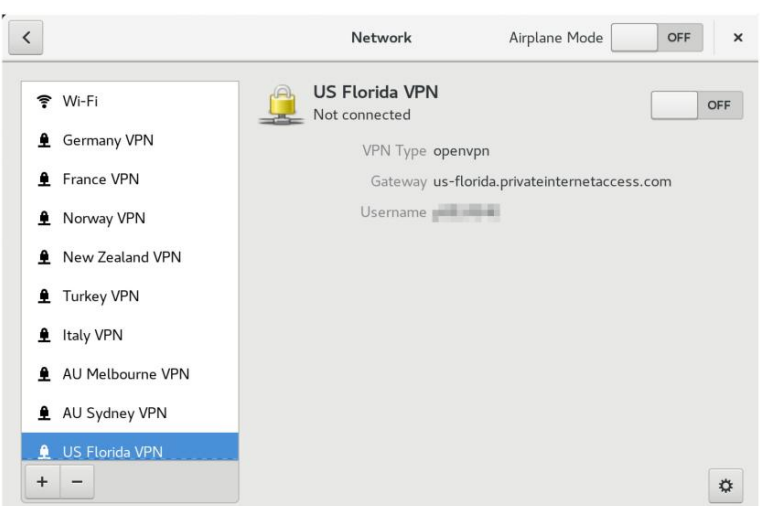
As I've written before, keeping your system updated will ensure that any security holes stay patched. Depending on the software you have installed, updates may be available daily. I recommend running an update at least once every two weeks.

If for some reason you'd prefer to keep the current versions of your software, you should still update your kernel at minimum.

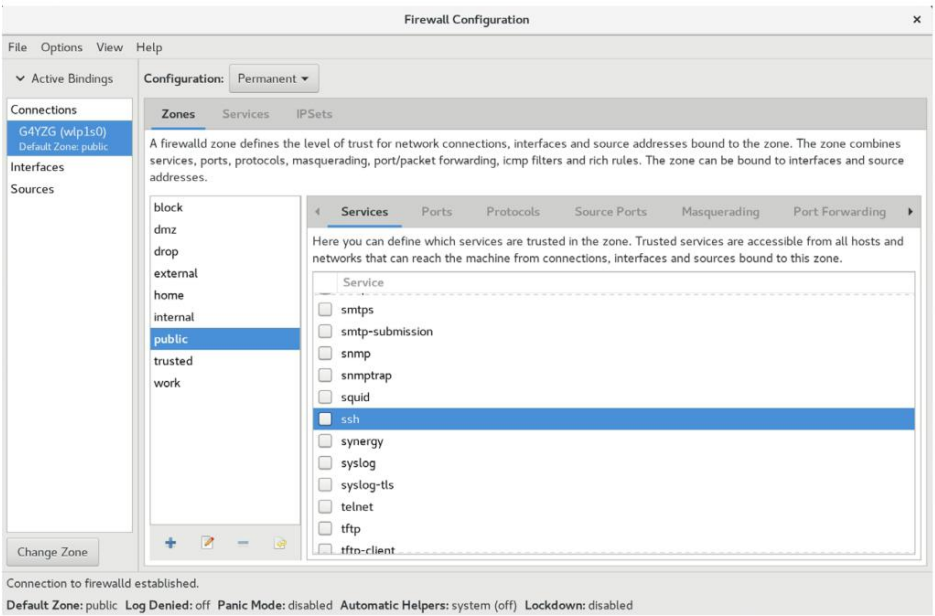
Don't trust strange networks

Next time you go to a college campus or coffee shop, take a look around. You'll probably see a collection of shiny, relatively new laptops, with people busily clicking, typing, and swiping away. It's a jackpot for thieves, but not the kind you might imagine.

Open Wi-Fi networks are a big liability. Anyone with the right



GNOME's networking settings window showing a list of VPN servers.



This screenshot of Firewalld shows that the port for SSH (port 22) is closed for the public zone.

software and wireless setup can sniff the unencrypted Wi-Fi traffic buzzing though the air. A virtual private network (VPN) should be a first line of defense whenever you're on a network away from home or the office. If you're unfamiliar with what a VPN does, take a minute to read up on it (go.pcworld.com/vpn5). When in doubt, VPN up.

If you want to use a VPN on Linux, you'll have to make sure you have the right packages installed. Most consumer VPNs will likely use the OpenVPN or IPSec protocols, but corporate VPNs may use Cisco's AnyConnect (go.pcworld.com/anycon). You can even set up a VPN at home (go.pcworld.com/whyvpn) on the cheap. Be sure to consult your distribution's package database to install the right plug-in for the protocol you're using. Fedora's manual has a step-by-step (go.pcworld.com/fedora2) description of how to connect to a VPN with the Gnome 3 desktop.

Keep your guard up

You can also install and run firewalls in Linux. Firewalls can help keep outsiders from making unwanted connections through the network. Unless your desktop or laptop is running a specific service (like Samba to share files with Windows machines), it's best to make sure the firewall denies access to incoming connections.

Linux users have a number of tools to choose from. I like Fedora's Firewalld (firewalld.org) because it is both versatile and easy to use, and allows a degree of granular control that's not overwhelming. The program allows the user to set zones based on connection or interface, and to define and control what services are allowed to accept traffic. Firewalld is available for several distributions through GNOME Software or other package managers. Gufw is another firewall (gufw.org) that allows far less granularity, but surpasses Firewalld in simplicity.

While Windows viruses may not affect a Linux machine, a Linux PC can still be a 'carrier' for a virus that's hiding in an executable file, script, or compromised document.

Run antivirus scans once in a while

Wait, what?

That's right, there are indeed viruses that target Linux. However, few of those viruses target desktop Linux, since the platform represents such a small percentage of market share. (Servers are another issue, go.pcworld.com/servervir.) While Windows viruses may not affect a Linux machine, a Linux PC can still be a "carrier" for a virus that's hiding in an executable file, script, or compromised document.

Since Linux and UNIX-like servers are so popular, the platform is targeted by viruses. However, given the application of said servers, antivirus solutions for Linux are often meant for the enterprise and business world. Consumers that run Linux are largely left out of the anti-malware market on Linux.

But of course, there's the open-source alternative. ClamAV is

available for free (and is in most distribution repositories, clamav.net), but requires a little configuration (go.pcworld.com/clamconfig) to get working correctly.

Back up your data

Last but not least, be sure to back up your data. A good backup can be a lifesaver, sparing you the significant expense and headache of having to recover lost data from a dead or irreparable drive.

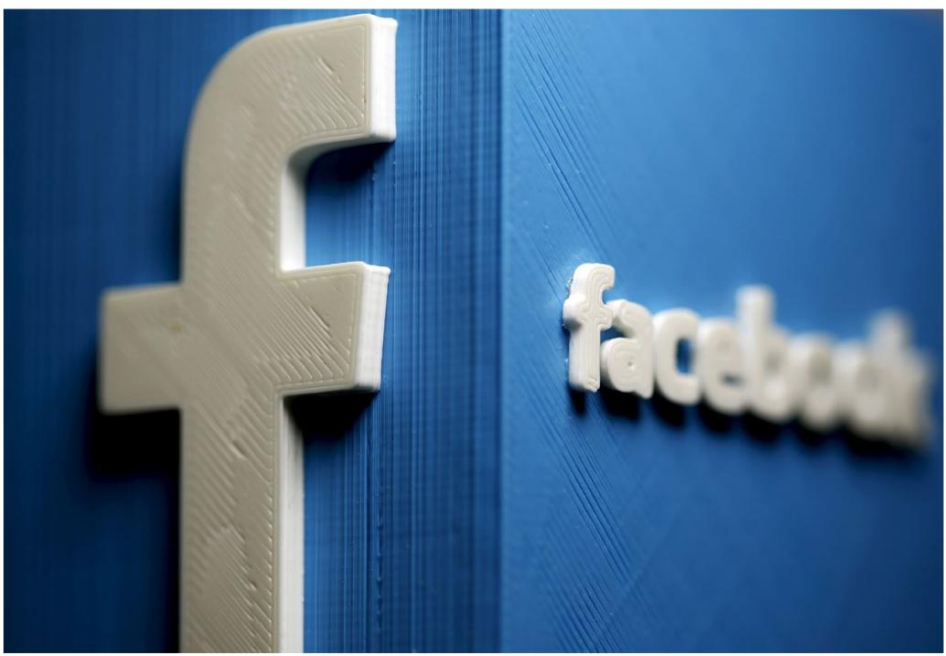
If you've got a backup of your data, you can pull a Sigourney Weaver and write off the PC's filesystem as lost and start from scratch.

Since most of the software you'll use with Linux can be downloaded from the Internet for free, your data and configuration files are really the only things that matter. There are several ways to back up data (go.pcworld.com/3backup) to an external source, including rsync and automatic backup services. However, the software you use often matters a lot less than the safety of the backup media and frequency of backup.

Linux is a rock-solid computing platform, but it's not indestructible or impervious to attack. By keeping an eye on your system and using appropriate defensive measures when warranted, you can ensure that your Linux PC (and the Windows PCs you share files with) stays squeaky clean of digital creepy crawlies.

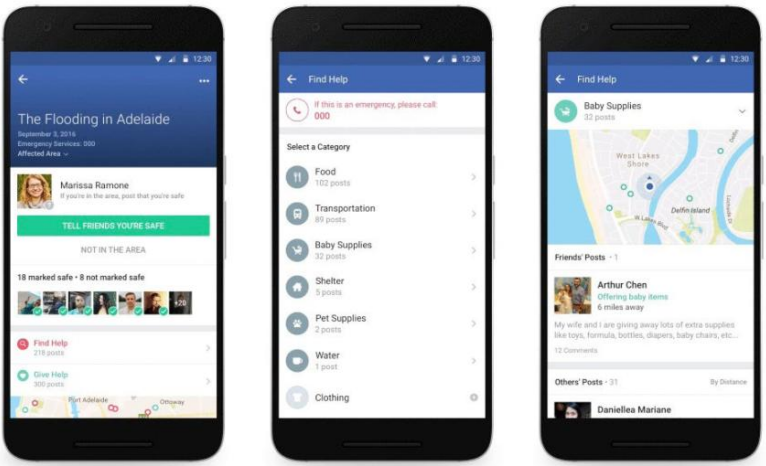
Facebook's Community Help lets you aid your neighbors in a crisis

BY IAN PAUL



FACEBOOK IS TAKING its Safety Check feature beyond the ability to just mark yourself and others as safe with a new addition called Community Help, which started rolling out recently. Facebook first announced Community Help (go.pcworld.com/febchelp) in November at the company's Social Good Forum.

Community Help allows Facebook users to offer each other



Facebook's Community Help

assistance for basic needs during a crisis. This can be food, a place to sleep, baby supplies, and other essential goods or services.

When Community Help is active, users in the affected area will see a Find Help link on the Safety Check page for their particular crisis. Underneath that will also be a Give Help option for those who want to assist their neighbors.

Community Help will initially be available to users in the United States, Canada, Australia, New Zealand, India, and Saudi Arabia.

Community Help was inspired in part by Facebook users who were already banding together to offer each other help in times of need. The company says it also consulted experts and humanitarian relief organizations to develop the new feature.

The impact on you at home: As Community Help is part of Safety Check it will only be available in times of crisis, but the feature won't show up for every emergency. Facebook says that it will only show up for accidental and natural disasters such as a flood or tornado. That may only be the beginning, however. The company says that as it learns from people using Community Help, Facebook will look to expand it to "additional types of incidents."

Recent WordPress vulnerability used to deface 1.5 million pages

BY LUCIAN CONSTANTIN

UP TO 20 attackers or groups of attackers are defacing WordPress websites that haven't yet applied a recent patch for a critical vulnerability.

The vulnerability, located in the platform's REST API, allows unauthenticated attackers to modify the content of any post or page within a WordPress site. The flaw was fixed in WordPress 4.7.2, released on January 26, but the WordPress team did not publicly disclose the vulnerability's existence until a week later (go.pcworld.

IMAGE: ALEXANDER GOUNDER/PIXABAY

com/wpvuln), to allow enough time for a large number of users to deploy the update.

However, even after the flaw became public, many webmasters did not apply the patch and a wave of attacks soon followed. Recently, web security firm Sucuri reported that around 67,000 pages had been defaced in four separate attack campaigns.

Since then the number of defaced pages has grown to over 1.5 million and there are 20 different attack signatures, according to statistics from Feedjit, the company behind the Wordfence security plug-in for WordPress. The number of unique affected websites is estimated at around 40,000, as a site can have multiple defaced pages.

Recently, web security firm Sucuri reported that around 67,000 pages had been defaced in four separate attack campaigns.

"This vulnerability has resulted in a kind of feeding frenzy where attackers are competing with each other to deface vulnerable WordPress websites," Mark Maunder, the CEO of Feedjit, said in a blog post recently. "During the past 48 hours we have seen over 800,000 attacks exploiting this specific vulnerability across the WordPress sites we monitor."

One interesting aspect is that attackers have managed to find a way to defeat the initial blocking rules put in place by web application firewall vendors and web hosting companies to protect their customers from attempts to exploit this flaw.

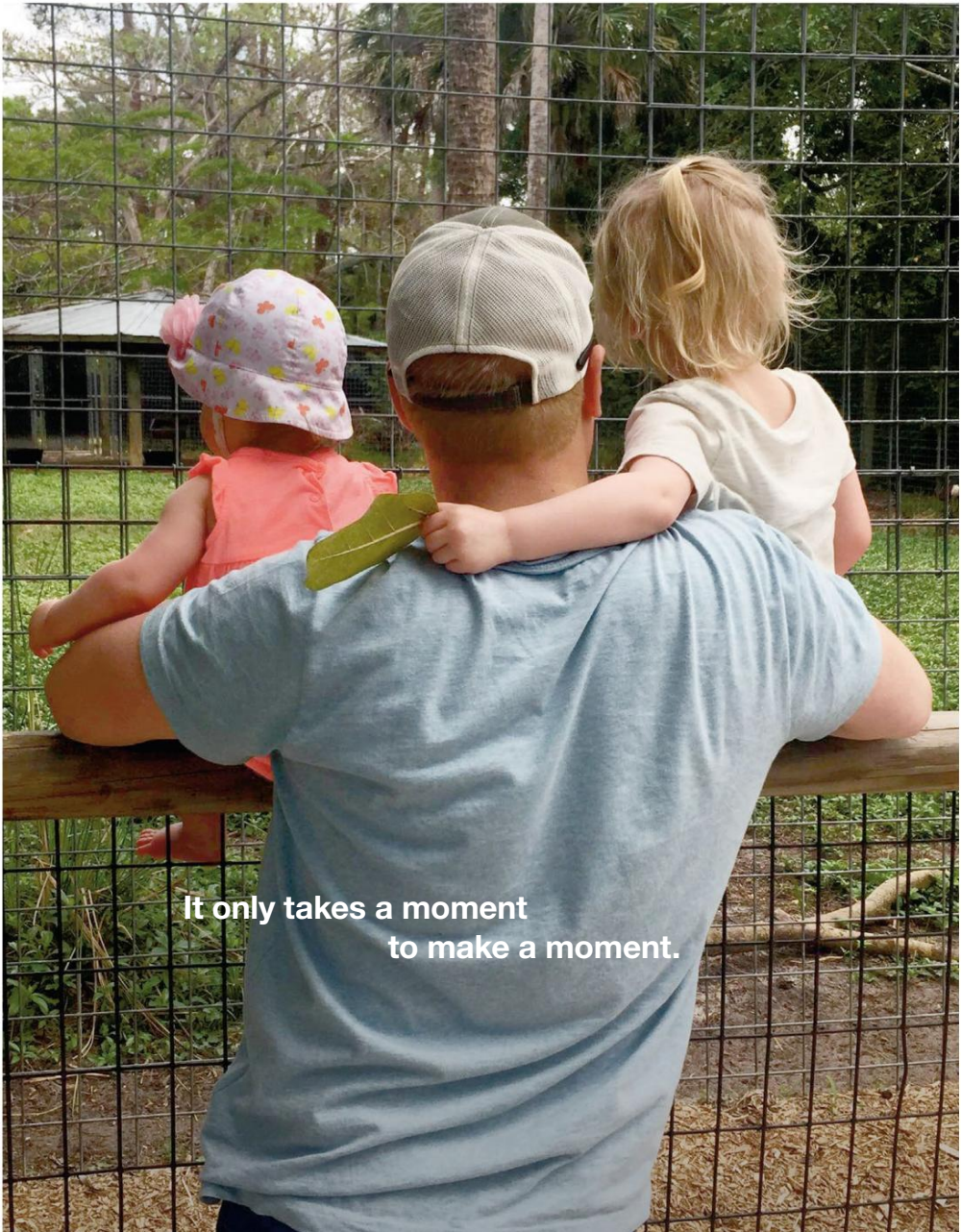
These companies can't force webmasters to update their WordPress installations, but they can put filters in place on their web servers to block such attacks from reaching their customers' websites. In fact, before releasing the official patch, the WordPress security team reached out to select web security and hosting firms to help them deploy protection rules for this flaw.

Google has also sent out security alerts regarding this vulnerability to webmasters who registered their WordPress websites in the Google Search Console service. The alerts advised them to install the

WordPress 4.7.2 update but generated some confusion (go.pcworld.com/wppatch) among users who had already applied the patch.

The truth is that despite these efforts, some WordPress installations won't be updated and will remain vulnerable to this flaw for a long time to come. This is based on past experience with other serious flaws that affected WordPress and similar content management solutions.

The bad news is that it's probably only a matter of time until attackers stop defacing pages and start injecting malicious code into them, affecting visitors to these sites.



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Tested: The truth behind the MacBook Pro's 'terrible' battery life

BY GORDON MAH UNG

READ PROFESSIONAL REVIEWS of Apple's new MacBook Pro lineup, and you'll come away thinking the new laptops have great battery life.

Dive into a customer forum, though, and the upshot will be exactly the opposite: The new MacBook Pros have "piss poor" battery life.

That characterization came from user yillbs on MacRumors.com (go.pcworld.com/mr). "I don't think anyone can convince me that this thing isn't just flat out the worst battery life ever on a MacBook," yillbs wrote, clearly frustrated. "I've been defending it like mad, but at this point… how can you? 4.42 hours is just bad."

User Happypuppy was anything but. "Not happy with the battery either. I was editing my MacBook review video last night and at 6:28 p.m. it was at 100 percent," Happypuppy wrote. "At 8:52 p.m. it was down to about 42 percent."

Contrast those write-ups with *Macworld*'s review (go.pcworld.com/mwmbp) which said: "Battery life is also solid, with both models lasting a full day of heavy use, with multiple apps open, dozens of Safari tabs, streaming music to Spotify, and occasionally indulging in some video viewing with Sierra's picture-in-picture feature."

Macworld isn't alone. From Laptopmag to The Verge and Notebookcheck.net, the vast majority of reviewers have lauded the MacBook Pros for good battery life.

Complaints about poor battery life on the new MacBook Pro lineup have been piling up—despite the laptops' high marks for battery life from professional reviewers.

The MacBook Pro 15 with discrete graphics has indeed suffered from a software problem that chews up the battery.

My own tests agreed. I'm no fan of the MacBook Pro's butterfly-switch keyboard, nor its lack of USB Type A ports, but one thing I do know is it has relatively good battery life. When I tested both a non–Touch Bar 13-inch MacBook Pro and the base 15-inch MacBook Pro some months ago, I was able to coax about nine hours of 4K video playback from each at 255 nits of brightness.

A search for the truth

The truth about the MacBook Pro's battery life had to be somewhere in this mess of conflicting results. I returned to the MacBook Pro 15 I'd tested before to put it through multiple run-down scenarios, charging and discharging the MacBook Pro 15 under different loads over the course of many days.

This particular MacBook Pro 15 is the baseline model with a Core i7-6700HQ, Radeon Pro 450, 16GB of LPDDR3/2133 RAM, and 256GB of flash storage. The OS I used in the majority of these tests was the latest public one available when I started my testing: macOS Sierra 10.12.2. I disabled automatic screen dimming and manually calibrated brightness using our Minolta photometer for each of the brightness settings I used.

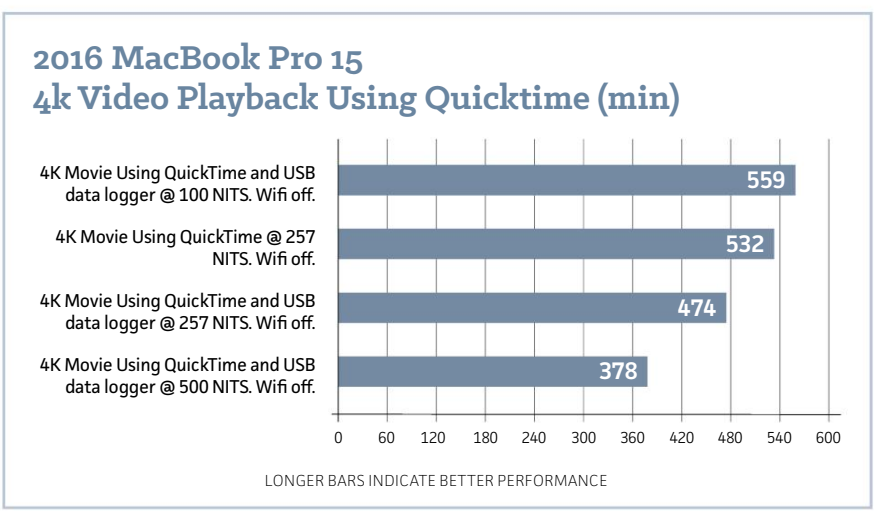
You'd typically run these tests multiple times to calculate an average to reduce variability. Given the considerable time it takes to perform individual run-down tests, I went with a more casual single-run scenario.

Video playback is still great

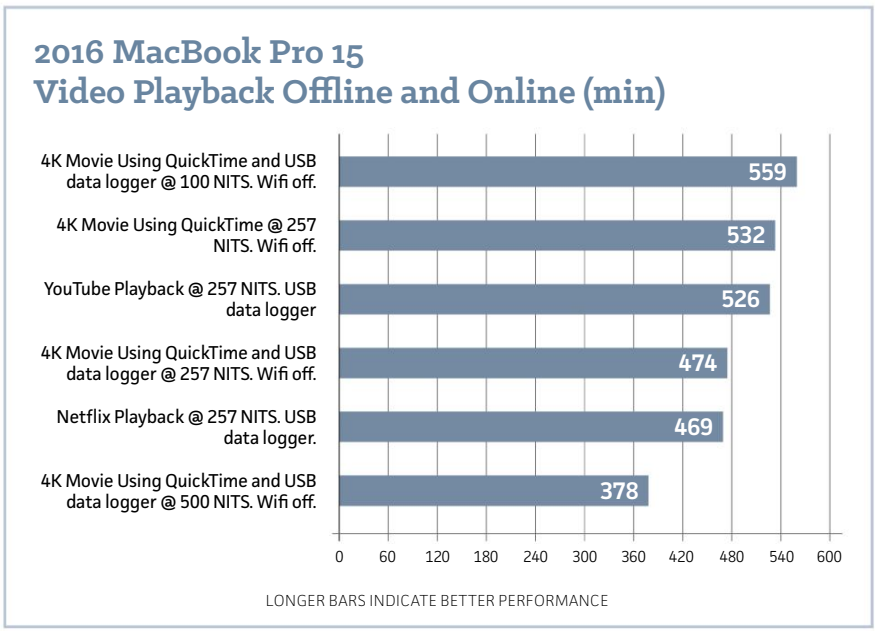
For the first test, I ran the open-source 4K movie *Tears of Steel* (go.pcworld.com/tos). The actual video player you use can have a huge impact on battery life (you can read more on this topic here go.pcworld.com/vp), so I opted to use Apple's QuickTime player. Apple's official video run-down test uses iTunes, but I've never figured out how the company is able to get the video to loop for its tests.

The video was looped with the Wi-Fi switched off and audio on. Rather than the laptop's speakers, I used earbuds to (theoretically) reduce the power drain from driving the larger speakers. The brightness settings I used were at a fairly dim 100 nits, a fairly bright 257 nits (which is a good setting for an office or home in the daytime), and finally, the laptop's maximum brightness setting of 500 nits.

The MacBook Pro 15 has pretty stellar life playing video. Set to 257 nits, we're seeing just about eight hours of battery life. Even more impressive to me is that at the blazing 500-nit setting, you can still get six hours of run time. Considering the 2880-by-1800 native resolution



You can expect from 6 to 10 hours of battery life playing 4K video, depending on the brightness of the screen.



Netflix and YouTube streaming also yielded fairly good battery run time on the new MacBook Pro 15.

and brightness of the panel, that's actually pretty nice.

There's one more result on the chart to be aware of, and that's the battery life when none of the laptop's USB-C ports are being used. For all the other tests, I used a self-powered device that logs the voltage of the USB port. This lets us know when the laptop is on, and when it finally dies.

This device works because on older MacBook Pros and most other laptops, the USB Type A ports are run on chips that are usually powered on at all times. The MacBook Pro, however, uses Thunderbolt 3 controllers. With Thunderbolt 3, the chip (go.pcworld.com/chp) appears to conserve power by switching off when not being used.

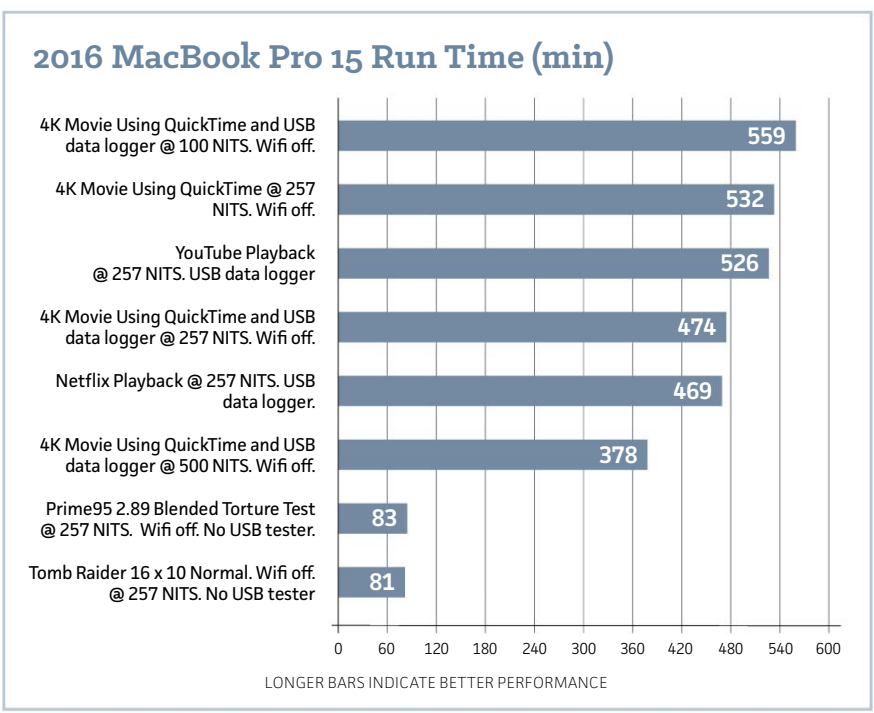
With our USB device in place, however, the Thunderbolt 3 chip appears to stay awake. The laptop itself did not log any power being

consumed by the Thunderbolt port, but the results pretty much match the consumption I've seen on another couple of laptops, so I think there's still a small cost in power.

The upshot: If you run a USB device on your MacBook Pro, you'll take a small hit. If you refrain from doing that, then you'll probably get slightly longer battery life.

Streaming video playback

Most video today is watched online, not offline. Using a brightness setting of 257 nits, I flipped on the Wi-Fi and measured how long it took to run down the MacBook Pro 15 on YouTube and Netflix. For YouTube, I picked a 24-hour Nyan Cat video (go.pcworld.com/nyan)



Push the GPU or CPU hard on the new MacBook Pro 15, and battery life will plummet.

that's pretty low-res. I don't get Nyan Cat, but apparently it's a thing. It's also a 24-hour video, so there wasn't a chance it would stop in the middle of the night and invalidate my test.

The YouTube video ran for just under nine hours, while the Netflix video was just short of eight hours.

Rather than pick a video on Netflix and try to rewind it every few hours, or try to binge-watch a show (which can be unreliable, as the video will occasionally stop streaming), I decided to use Netflix's internal test video (go.pcworld.com/ntf) called Example 8 hour 23.976. I intentionally forced the video bit rate to the 4870 option. Audio was on for both, and I used a set of earbuds.

The results look good. The YouTube video ran for just under nine hours, while the Netflix video was just short of eight hours.

Battery life under hard use: This is the tricky part

When you're looking at this category of laptop, however, you shouldn't expect people to limit their chores to light duty. It is a "pro" laptop, right? One thing I don't think people understand is just how much of a penalty you pay when you push the GPU or CPU very hard.

To find out, I ran two tests. The first used the game *Tomb Raider.* I set the game for 1680x1050 resolution on the medium setting and ran the game's built-in benchmark. Once the benchmark is finished, it continues to loop a 3D scene. I then unplugged the MacBook Pro 15 and let it run down to zero. This particular test is mostly a load on the GPU, but the CPU is working as well.

After recharging the laptop, I ran the test using Prime95, which is a pure CPU test. I used the Torture Test Blended mode and manually recorded when the laptop died.

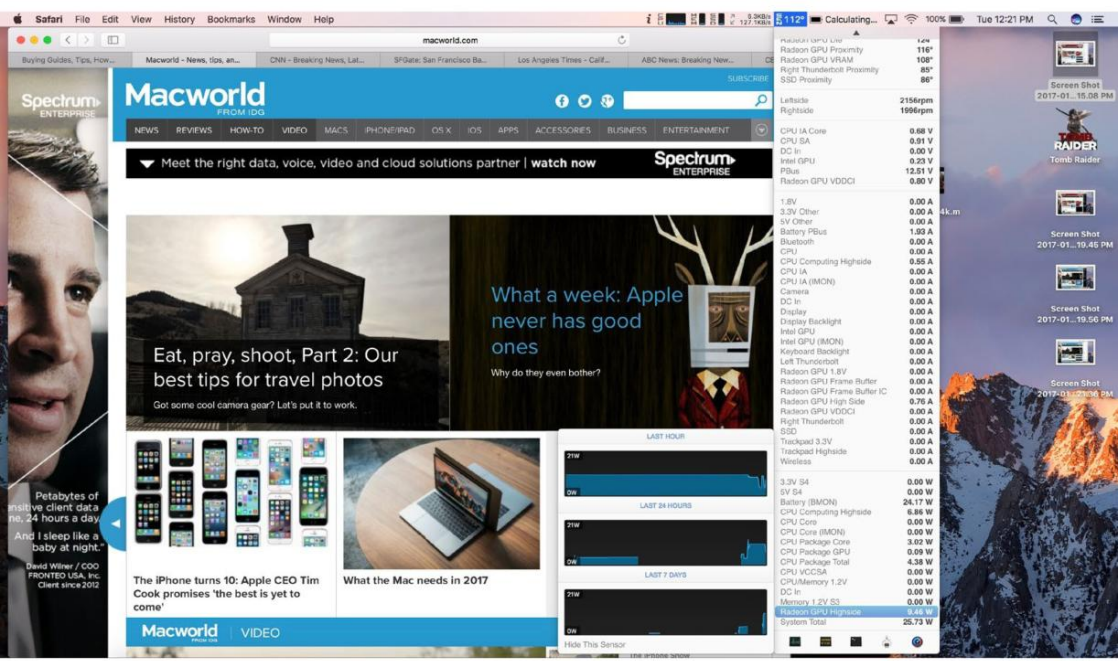
Both tasks emptied the battery in just over 80 minutes. You can see how drastic the battery situation gets depending on how hard you push it. Drive it hard, and you'll be lucky to get an hour or so out of it.

The point of these two tests is to address the people who say they "just did a little video editing" or some other intensive tasks for a "short

time" before the battery ran down. Look at this chart and then think about your mix of work. A short time is all you should really expect if the task really pushes that CPU or GPU. On intensive tasks, the only way to get longer life is use a larger battery (more on that later.)

There was, indeed, a bug

In looking at other battery run-down scenarios, I ran smack into a problem that's likely at fault for many of the confusing battery-life issues with the laptop, at least in macOS Sierra 10.12.2. On occasion, the laptop's discrete GPU would just get stuck on and consume power even when it wasn't used. Others had reported this too, but you'd really have to stumble onto it.



You can see from this screenshot of the 2016 MacBook Pro 15 running Sierra 10.12.2 that the discrete GPU is consuming power even though the laptop has switched over to integrated graphics. That power drain would occur sometimes even after we quit Safari.

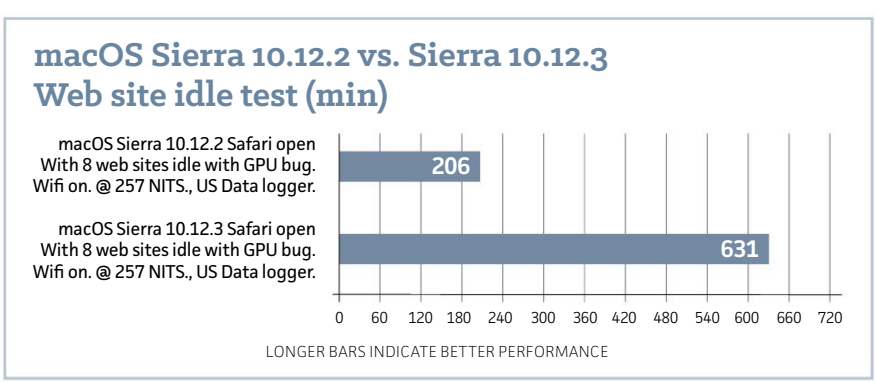
I was able to reproduce the issue in Safari by opening Google Maps, which would cause the laptop to switch over to the GPU for the WebGL workload. Opening additional browser tabs and then closing the Google Maps tab would, on occasion, leave the GPU consuming up to 10 watts of power while doing absolutely nothing.

I performed an idle test with Safari open to Google Maps. This switched on the Radeon Pro, which would consume about 5 watts just idling.

Even though the MacBook Pro 15 had switched back to Intel graphics, the Radeon Pro would just suck up power. How much? I found after triggering this bug that I could kill the laptop in just 206 minutes, or a scant three and a half hours of basically idling with Safari open, Wi-Fi on, and eight websites loaded.

This isn't just a blame-discrete-graphics moment, either. I performed an idle test with Safari open to Google Maps. This switched on the Radeon Pro, which would consume about 5 watts just idling. With Wi-Fi on and the screen set to 257 nits—but essentially nothing happening—the battery stretched out to 1,135 minutes, or just shy of 19 hours.

This particular power drain isn't completely the fault of the Radeon Pro. I suspect this to be the cause of many of the problems people are reporting.



An apparent bug in MacOS 10.12.2 and Safari would cause the Radeon Pro to consume energy even when it wasn't being used. Apple appears to have fixed it in 10.12.3.

What Apple fixed

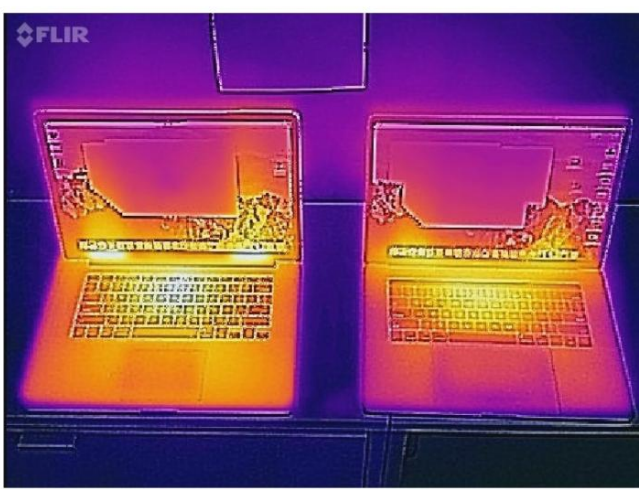
The Sierra 10.12.3 update seems to have fixed the problem. Apple officially says the update "improves automatic graphics switching on the MacBook Pro 15," and it does.

I could no longer get the Radeon Pro to consume phantom power. It's as though Apple basically increased the graphics load requirement before firing up the power-hungry GPU. Google Maps and even more intensive WebGL tasks would no longer fire up the Radeon Pro at all. Most of the time you really don't need it, as the Intel IGP is generally more than enough for web graphics.

I tested the updated OS running the same task that earlier gave me the horrible 206 minutes of battery life under Sierra 10.12.2. The battery life stretched out to 631 minutes under Sierra 10.12.3.

Interestingly, I never initiated the developer mode that Consumer Reports did when it initially held back (go.pcworld.com/cr) on recommending the MacBook Pros to consumers. Consumer Reports' tests found the battery life to be all over the map and attributed it to the developer mode it used in its browser test.

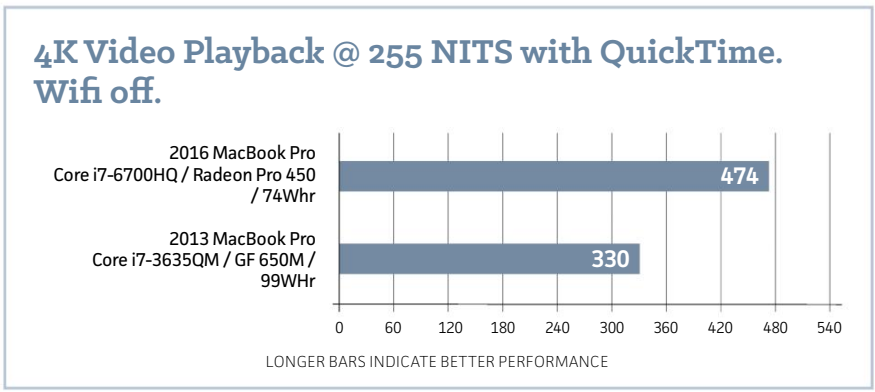
Once Apple patched the OS, Consumer Reports (go.pcworld.com/cr2) reversed its decision. Those fixes eventually went into the final release of Sierra 10.12.3, but it's not clear to me what exactly happened in the situation that Consumer Reports ran into.



Seen through our FLIR thermal viewer, you can see the older 2013 MacBook Pro 15 (left) or the new 2016 MacBook Pro 15 (right) getting toasty when their CPUs are pushed hard.

The smaller battery is clearly a limitation

If you think the battery life situation (at least on the MacBook Pro 15) is solved, there's something else you should



Even with a battery that is 25 percent larger, the older 2013 MacBook Pro 15 can't beat the efficiency of the new 2015 MacBook Pro 15 model.

consider that can't be fixed in software: the smaller battery.

Prior to the 2016 MacBook Pro 15, Apple shoved giant 99.5-watt-hour batteries into the MacBook Pro 15 series. With the thinner, lighter late-2016 model, Apple reduced the size of the battery by almost 25 percent to 76 watt-hours. This downsizing has a real cost. While the new MacBook Pro 15 is impressively efficient, sometimes efficiency isn't enough.

If you think of cars, many factors contribute to the driving range between refueling, including the size of the gas tank, how aerodynamic the car is, and how efficient the engine and transmission are. On a laptop, the battery capacity, measured in watt-hours, is akin to the fuel tank. The power efficiency of the CPU, GPU, and components could be the engine and transmission efficiency. The amount of power the display uses could be the aerodynamics.

As you saw from the previous numbers, the general efficiency of the display, CPU, GPU, and other system components on the 2016 MacBook Pro 15 are actually quite good.

It also compares quite favorably with older systems. To illustrate this, I grabbed a MacBook Pro 15 circa 2013. This laptop was built with a quad-core Ivy Bridge Core i7-3635QM and GeForce GT 650M graphics.

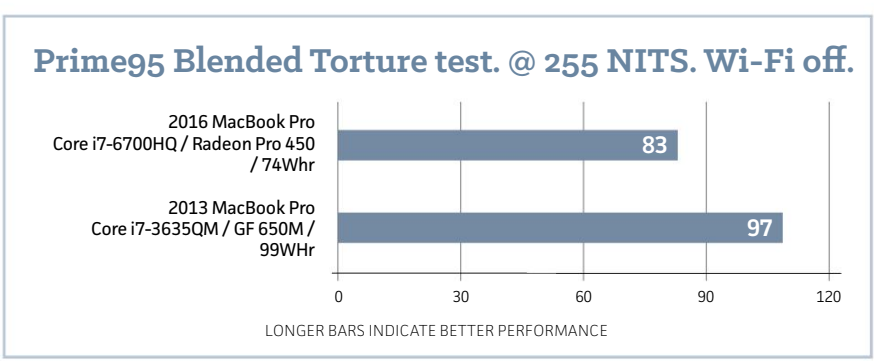
It has 8GB of RAM and a 256GB SSD. This older MacBook Pro 15 also features just about the largest permanent laptop battery allowed by law onto a plane—99.5 watt-hour (go.pcworld.com/99). Despite its age, the battery itself was in good shape, with fewer than 10 discharge cycles on it and a health report of 99 percent.

A clean install of macOS Sierra 10.12.1 was used before testing. First came our 4K video run test at a brightness of 255 nits, Wi-Fi off, and our USB data logger in place. I should note that this model doesn't have a Thunderbolt 3 chip, so there's no power cost from having a USB device plugged in.

Even with its larger 99.5-watt-hour battery, the 2013 MacBook Pro 15 tapped out at only 330 minutes, which is well south of 6 hours. Compare that to the 2016 MacBook Pro, which, with its 25-percent-smaller battery, made it all the way to 474 minutes, or almost two hours more run time.

During video playback, both used the integrated Intel graphics and were mostly idling. The 2013 MacBook Pro 15 consumed about 18 watts, while the 2016 MacBook Pro 15 used about 13 watts.

The other factor in fuel mileage is how hard you drive it. No matter how efficient the engine is or how aerodynamic the car, sometimes having a larger fuel tank matters more.



When you drive both laptop CPUs really hard, the efficiency of the newer 2016 MacBook Pro 15 can't make up for the giant battery in the older MacBook Pro 15 model.

To prove this point, I tasked the 2013 MacBook Pro with the same Prime95 torture test as the 2016 model. This test, if you recall, basically pushes all cores of the CPU as hard as possible. In car terms, it would be like flooring it fully loaded with passengers and luggage while going up a mountain. You're burning a lot of fuel.

The older 2013 MacBook Pro has that in spades with its 99.5-watt-hour battery. It was able to run flat out for 97 minutes before dying. The newer 2016 MacBook Pro, as efficient as it is, can't push the CPU that hard for that long before emptying its 74-watt-hour battery at 83 minutes.

Increasing the battery capacity by 25 percent may not yield exactly 25 percent more battery life, but it would certainly last longer than it does now under heavy-duty loads.

Increasing the battery capacity by 25 percent may not yield exactly 25 percent more battery life, but it would certainly last longer than it does now under heavy-duty loads. Those who actually use their MacBook Pro 15 in heavier tasks on battery may indeed experience shorter run times than with older models, especially if their point of reference is a more recent and more efficient Haswell- or Broadwell-based model.

And the tests say: Your mileage will vary

After all that battery testing, there are several takeaways:

- The 2016 MacBook Pro 15 did indeed have a bug that would sometimes cut short battery life. Apple appears to have corrected the problem.
- I found that plugging the MacBook Pro 15 into an external monitor engaged the discrete GPU full time at a cost of 9 watts. While it's unlikely you'd be at a desk using an external monitor without being plugged into AC, if you do, expect poor battery life.
- The newer MacBook Pro 15's 500-nit screen is brighter. If you're comparing it to an older MacBook Pro 15, use the same brightness settings to make the comparison fair.

- As reviewers originally found, the MacBook Pro 15 still has pretty decent life for a notebook in its class. Eight to nine hours of video playback at 257 nits on a quad-core equipped laptop with discrete graphics is very respectable. Comparable Windows laptops I've seen with quad-core CPUs, 4K screens, and discrete graphics generally offer worse battery life.
- Apple may have compromised too much by putting a smaller battery in the MacBook Pro 15. It's clear from the testing on the older Ivy Bridge MacBook Pro 15 and the newest MacBook Pro 15 that the 76-watt-hour battery can yield shorter battery life on heavier loads.
- How much battery life should you expect? Well, as the tests hereshow, depending on what you're doing, the answer is anywhere from an hour and a half to 18 hours. Not satisfied with that answer? Unfortunately, it's the only correct one, as battery life on any laptop will vary depending on what you do. 

Dell XPS Tower Special Edition: It's faster than it looks

BY JOSH NOREM

BACK IN THE day, Dell's XPS desktops were fire-breathing gaming machines. They could take on the best from Falcon Northwest, Alienware, Origin, and the rest of the "money is no object" boutique builders.

Then Dell bought Alienware, and the XPS desktop lineup moved away from big, beefy gaming rigs to Alienware, and instead focused on "premium design." (Read: desktop towers that you'd be hard-pressed to tell apart from their non-gaming counterparts.)

Judging by the redesigned XPS Tower Special Edition (go.pcworld.com/xpstowerse), Dell remains committed to that division between its brands. Instead of an all-out battle station, this refreshed XPS offers a rock-solid gaming experience that runs coolly and quietly in an extremely understated design.

Chassis and ports

The big news with the XPS Tower Special Edition is its retooled chassis. The frame is now 27 percent smaller than the previous one, measuring just 15 inches tall and 14 inches deep. Dell's achieved this shrinkage by moving some of the drive bays and putting the power supply over the CPU area.

Despite the tight design and single case fan—a 120mm spinner that sits atop the system at the back—airflow doesn't seem to be an issue. (Skip ahead to the "Acoustics and thermals" section for how the machine performs during stress testing.) Tinkering with the system's hardware is easy, too. When you pop off the side door via an easy-to-pull hinge on the back of the system, you can see two things: the power supply assembly and the GPU. If you pull on two more latches, you can release the power supply, which is attached to an arm that swings out from left to right. Getting access to the CPU is as simple as moving the PSU and its metal assembly out of the way.

Dell XPS Tower Special Edition

AT A GLANCE

This gaming PC might not give you a rush each time you look at it, but it gets the job done quietly and without any drama.

PROS

- Runs quiet and stable
- Thoughtful layout allows for easy upgrades
- Affordable

CONS

- Only the most expensive configuration offers a solid-state drive
- Plastic used for the case feels a bit cheap

$1,250

★★★★★

You can release the power supply, which is attached to an arm that swings out from left to right.

For later expansion, you get just two empty 3.5-inch drive trays: one on the bottom of the chassis, and one that attaches where you'd normally expect a front intake fan. There's also an M.2 slot on the motherboard that supports PCI Express.

In exchange for the limited number of bays, the system can handle up to 10.5-inch GPUs—or nearly every high-end video card available. A notable exception would be the Titan X Pascal, but given that the included power supply is 460W, you wouldn't be able to support one on the included PSU anyway. The 225W limit for the GPU via its dual six-pin PCIe power connectors is enough for a GTX 1080 (which has a TDP of 180W), but it's not enough for a Titan X (TDP rating of 250W).

On the back of the machine is a bank of four USB Type-A ports; three of which are USB 3.0 and one is USB 3.1, and there's another Type-C USB 3.1 port next to it as well. Additionally there's one gigabit LAN port, two USB 2.0 ports, and audio jacks. The front of the PC features

four more USB 3.0 ports, an SD card reader, headphone/mic inputs, and a super-slim optical drive. The only thing missing is a USB-C port, but given the current state of USB-C implementation, you won't need one just yet.

The hardware

Two versions of this computer exist: the XPS Tower and the XPS Tower Special Edition. The two models look the same visually aside from the color of the diamond-cut faceplate: The standard version's is piano-black, while the Special Edition's is gray.

Of the two options, the Special Edition (the model we're reviewing) is the only one that offers high-end CPUs and GPUs, and thus the only version suitable for high-end gaming. For example, the Special Edition offers the option of an unlocked Core i7 K-series processor that you can overclock in the BIOS, while the regular version offers only locked processors. You can upgrade to a GTX 1070 or GTX 1080 with the

On the back of the machine is a bank of four USB Type-A ports; three of which are USB 3.0 and one is USB 3.1, and there's another Type-C USB 3.1 port next to it as well. Plus, one gigabit LAN port, two USB 2.0 ports, and audio jacks.

Special Edition, while the standard model restricts you to a GTX 960 or worse.

Our review unit is the base configuration with a GPU upgrade. This config starts at $1,000 for a Core i5-6400, Radeon RX 480 GPU, 8GB of DDR4/2133 RAM, 1TB 7200rom hard-disk drive, and support for 802.11ac wireless. This variant with a GTX 1070 Founders Edition card bumps up the price to $1,250. That's a reasonable figure, though of course you could build a similar system for less if you did some careful deal-hunting. (You won't be able to replicate the precise, compact layout of Dell's tower, though.)

The front of the PC features four more USB 3.0 ports, an SD card reader, headphone/mic inputs, and a super-slim optical drive.

All in all, you get a processor with four cores and no Hyper-Threading that runs at a 2.7GHz base clock with a 3.3GHz boost clock, plus sufficient RAM and a fairly spacious storage drive. Dell offers three other primary configurations of the Special Edition, each further customizable, so if you have your heart set on a faster CPU or graphics card, more memory, an SSD, or a bigger hard drive, you can have it. Just be ready to dole out a lot more cash: The highest-end config starts at $1,900.

Performance

With a midrange Core i5 CPU and GTX 1070, the Dell XPS Tower Special Edition is a decent gaming machine (especially given its price). Its hardware does have some limitations, however, which are especially noticeable when compared to PCs with Core i7 chips. Overall, though, it still provides a mighty fine experience. Let's dig in.

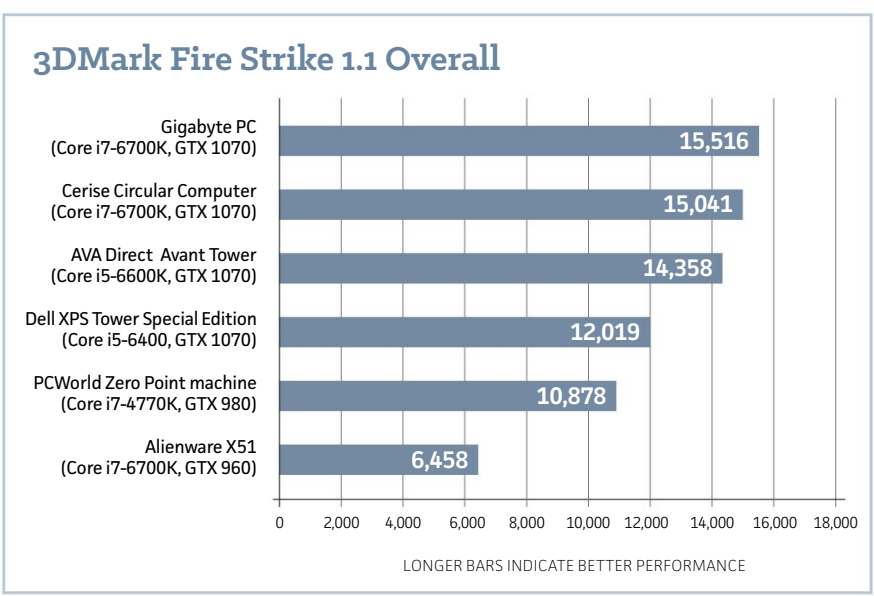
3DMark Fire Strike

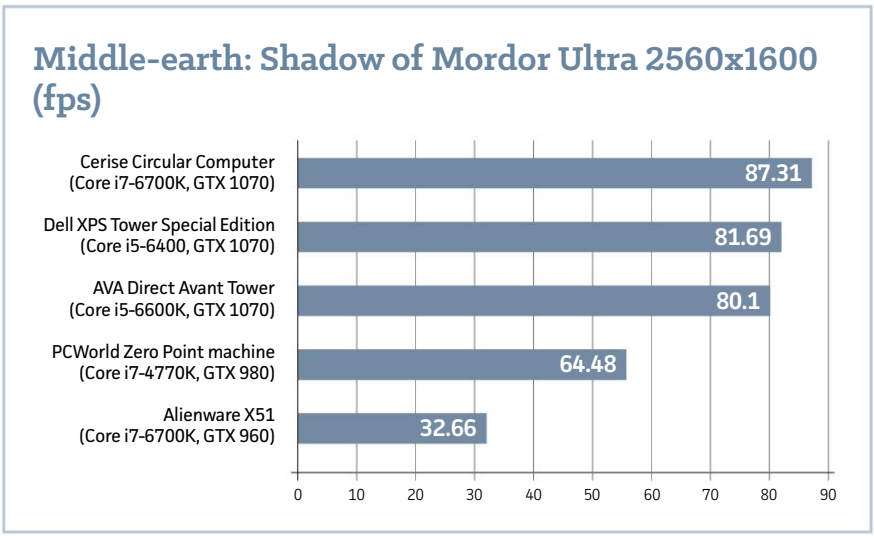
Because the XPS Tower Special Edition is meant for gaming, we hauled out 3DMark's Fire Strike as our first benchmark. It's a synthetic test that everyone knows and loves because it scales well and does an excellent job of replicating real-world results. It also takes into account both CPU and GPU power, which reflects clearly in this Dell desktop's results.

Though the XPS Tower has a stock GTX 1070, it didn't perform quite as well as the other GTX 1070 systems we've seen. Its midrange Core i5 processor constrains overall performance—relative to the top dog in our comparison, which paired a swift Core i7-6700K with a GTX 1070, the XPS Tower was 22 percent slower. Even AVA Direct's Avant Tower, which uses a mini version of the GTX 1070, outperforms this Dell desktop thanks to its speedier CPU.

Middle-earth: Shadow of Mordor 4K

At a little over two years old, *Shadow of Mordor* can still clearly show the leap in performance between last-gen graphics cards and today's





Polaris and Pascal GPUs. We fired it up with the settings on Ultra and the 4K texture pack installed.

In this particular game and at this particular resolution, the XPS Tower Special Edition's Core i5 chip doesn't play as much of a role as during 3DMark's Fire Strike test. Dell's tower sits right in the same pocket as the Avant Tower—slightly behind the Cerise, but roughly in the same neighborhood. We did see a slightly bigger gap open up in our 1920x1080 benchmark, with an 11 percent drop in performance between the Dell and the Cerise. (The Cerise ran at 132.08 fps vs. the Dell's 116.57 fps.)

That said, the XPS Tower still delivers a great gaming experience at either resolution. For context, our PCWorld Zero Point machine's GTX 980 just managed to hit the golden minimum of 60 fps at 2560x1600, while the Alienware X51 (a more space-constrained desktop) eked out just over 30 fps.

Rise of the Tomb Raider

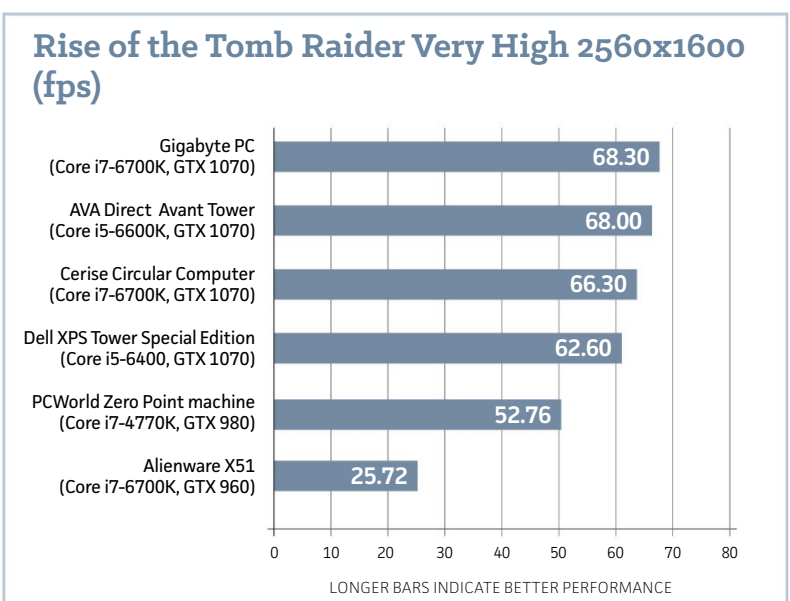
To ramp up the pressure a little more (and to see how the XPS Tower would do in a different game), we next fired up *Rise of the Tomb Raider*.

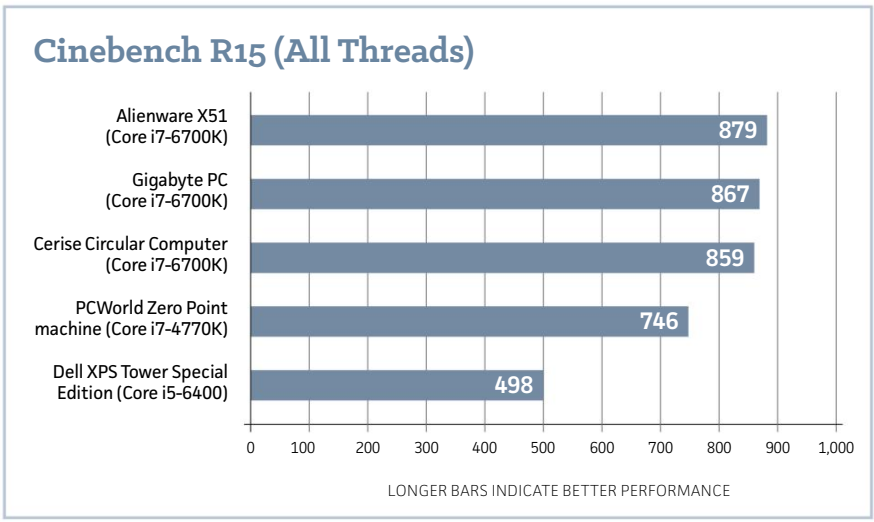
This game's a little over a year old at this point, but still gorgeous and plenty rough on a GPU.

Like in 3DMark's Fire Strike, the XPS Tower slips to the bottom of the GTX 1070 pack. It's about an 8 percent drop in performance relative to the Gigabyte PC, though in actual frames per second it's not an enormous difference. You still hit that minimum of 60 fps. In comparison, our zero point machine's GTX 980 falls below that threshold, while the X51's GTX 960 (which was never really meant for 2560x1600 gaming, much less 2560x1600 on the highest graphics setting preset) struggles along.

Cinebench R15

With gaming performance settled, we moved on to testing workstation duties. Cinebench R15 is a pure CPU test that tasks the processor with rendering a 3D scene using either one or all of the cores at hand. Like any good CPU benchmark, it takes advantage of





everything a CPU has to offer, so more cores and higher clocks always work out better. With the Dell running a much more budget-minded chip than the rival gaming machines we're comparing it to, we expect a more modest outcome.

Looking at the results makes us want to call an ambulance for the XPS Tower. Nobody was expecting it to pull off miracle performance, but even the Haswell i7 processor in our zero-point machine gave that i5-6400 (which is two generations newer) a good wallop. Overall, the XPS Tower will handle day-to-day tasks fine, but if you're going to task it with heavier work that taps all of the CPU cores—it's not going to outperform even older Core i7 chips. That point is also pressed in our next test.

HandBrake Encoding

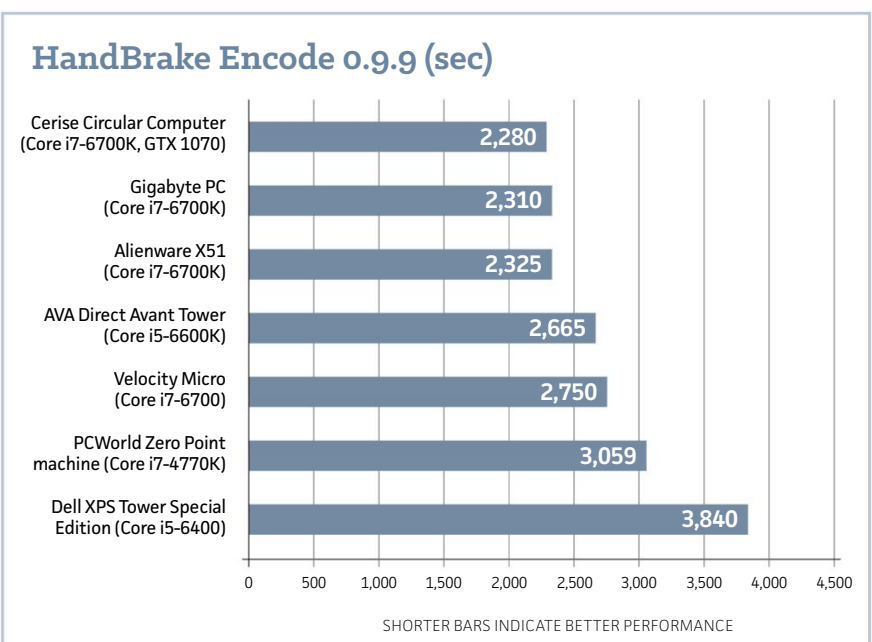
For an idea of how a system will perform during longer CPU-intensive tasks, we turn to HandBrake. It's a free encoding program that relies entirely on the CPU and scales well with core count.

For our benchmark, we drop a 30GB MKV file into HandBrake and then convert it into an MP4 file using the Android Tablet preset. The

more cores a processor has, the faster it goes. A system with a 10-core Broadwell-E chip can chew through this test in about 17 minutes, while a mobile processor can take up to two hours (as long as the system doesn't throttle the clock speeds as the chip heats up). Because the XPS tower rocks a 65W processor that falls in the middle of that lineup, we expected its score to do likewise.

While the Core i5-6400 can run at a boost speed of 3.3GHz when it means business, it hummed along at a steady 3GHz for this test. For context, that's 1GHz slower than the Core i7-6700K in the Cerise build, and that CPU also has four additional logical cores. The difference in time between the two systems ended up being 26 minutes, which is substantial since the XPS took 64 minutes to complete the test.

A more fair comparison is with the AVA Direct system, which has a higher-clocked i5 processor with the same number of cores but boosts up to 3.9GHz. That clock speed advantage allowed it to finish 20



Two versions of this computer exist: the XPS Tower and the XPS Tower Special Edition. The standard version's diamond-cut faceplate is piano-black, while the Special Edition's is gray.

minutes faster than the XPS Tower, so again, that faster clock does matter. If you plan to do any video encoding on this XPS and value your time, consider upgrading the CPU. The next model up in the product stack will set you back an additional $300, but it has a Core i7-6700 CPU, 16GB of RAM, and a 2TB HDD, so it's a decent all-around upgrade.

Acoustics and Thermals

I have to admit, when I looked at this tower after opening it up, it seemed ill-designed for thermals. Air flow seemed restricted, and that huge power supply sits directly over the CPU. (It also seems to block the case's only exhaust fan.) I was sure this puppy would run nuclear-hot if I pushed it hard enough…but I was wrong.

This XPS didn't lock up or show any signs of distress despite running Prime95 for hours. The CPU maintained a hot-but-comfortable 68 degrees Celsius the entire time. More impressively, the system made no noise whatsoever—it really is quiet and stable. Score one for big PC OEM engineering.

I should note that this system does sport a 65W CPU, so it shouldn't get that hot in the first place. Still, the air-cooler Dell installed worked quite well.

On the GPU front, the GTX 1070 climbed to a maximum temperature of 82 degrees Celsius when we looped Unigine's Heaven 4.0 benchmark for a few hours. It ran at a steady 1,784MHz the whole time, too, which is above Nvidia's listed boost clock for the stock version of this particular GPU.

Final thoughts

The XPS Tower Special Edition may not look like much, but if you're looking for a no-hassle machine that's VR-capable, upgradeable, and both quiet and stable from day one, it fits the bill.

Speaking of virtual reality—Dell has positioned all of its Special Edition models of the XPS Tower as VR-ready boxes. So whether you choose the base configuration, which includes the RX 480, or upgrade to a GTX 1070 or GTX 1080, you're good to go.

Overall, the XPS Tower Special Edition is a bit like a Honda Accord. It might not give you a rush each time you look at it, but it gets the job done quietly and without any drama. About the only thing that would improve it is the option of an SSD for all configurations, not just the most expensive, but luckily, you can always upgrade the storage yourself.

Apricorn Aegis Secure Key 3z: This USB thumbdrive is small, secure, and device-agnostic

BY JON L. JACOBI

WE WERE ALREADY fans of Apricorn's keypad-sporting secure drives, especially the small Aegis Secure Key 3.0 (go.pcworld.com/aegisk3), which is only a little larger than your garden-variety USB thumbdrive. Now there's the Aegis Secure Key 3z, which is the size of a standard thumbdrive—approximately 3.2 inches long, 0.75 inches wide, and 0.37 inches thick. Okay, a slightly long thumbdrive.

Lacking the 3.0's keypad cover, the 3z looks like a 1/8-scale garage-door opener when you pull it out of your pocket, but so what? Exposing the keypad lets everyone know they're not going to get the data off your drive, so don't bother. On the other hand, if you're really trying to fly under the radar, just keep it in your pocket.

The 3z is FIPS-140 Level 3 certified for security, is pending IPS57 certification (Q2 2017) for dust and water resistance, and is kind of fun to use.

Device agnostic

Formatted in FAT32 or exFAT, with the keypad obviating the need for lock/unlock software on the host device, you can use the Aegis Secure Key 3z on anything that recognizes USB mass storage. Computer, smartphone, Blu-ray player, industrial controller, car stereo, you name it; it should be able to read the unlocked 3z. Note that if you use only Windows PCs, formatting in NTFS, which is what we tested with, will give you better small-file write performance.

The 3z's keypad is tiny, but quite usable. Buttons require a firm press, but nothing that should concern any but the most fragile users. There are three status lights above the keypad to tell you whether the drive is locked (red), ready for programming or unlocking (blue), or unlocked (green).

The lock and unlock function buttons reside below the keypad. To enable the drive and security, you press the unlock button plus 9, then enter a PIN, which must consist of seven nonrepeating numbers. Repeat the process and you're good to go.

The 3z has a small rechargeable battery on-board so you can unlock the drive prior to inserting it into the USB port. Even if you somehow let the battery die,

Aegis Secure Key 3z

AT A GLANCE

This small keypad-secure flash drive is FIPS 140-2 certified, and it's easy to use. It's also relatively affordable and can be configured en masse using Apricorn's 10-port USB Configurator for shops looking to roll out users and PINs for fleets of the devices.

PROS

- Keypad allows you to access data from any PC or device
- FIPS 140-2 cryptography
- Smallest keypad-secured storage available
- $99 USB hub and software allows configuration of up to 10 devices at a time

CONS

- Runs hot

$79

★★★★½

don't worry—you can unlock the drive while it's being powered and recharged by the USB port. Apricorn says the battery should last about six years under normal use. The unit is warrantied for three years including the battery.

Cap off...cap on...
cap off...cap on...

Performance

The 3z proved a decent performer for an external USB thumbdrive, if you keep in mind that all data is being encrypted to the 256-bit AES XTS standard. Don't buy a super-secure drive if you want scintillating performance—that's not the point.

AS SSD rated the drive as reading at 136MBps and writing at 28MBps. But that write number is the bare NAND performance as AS SSD issues the FUA (Force Unit Access) command before testing. CrystalDiskMark was more optimistic, and probably realistic, rating the 3z for writing at around 107MBps. Our real-world 20GB single-file write test took 4 minutes, 31 seconds, or 71MBps, splitting the difference. Writing 20GB worth of files and folders took 5 minutes, 41 seconds, or 59MBps.

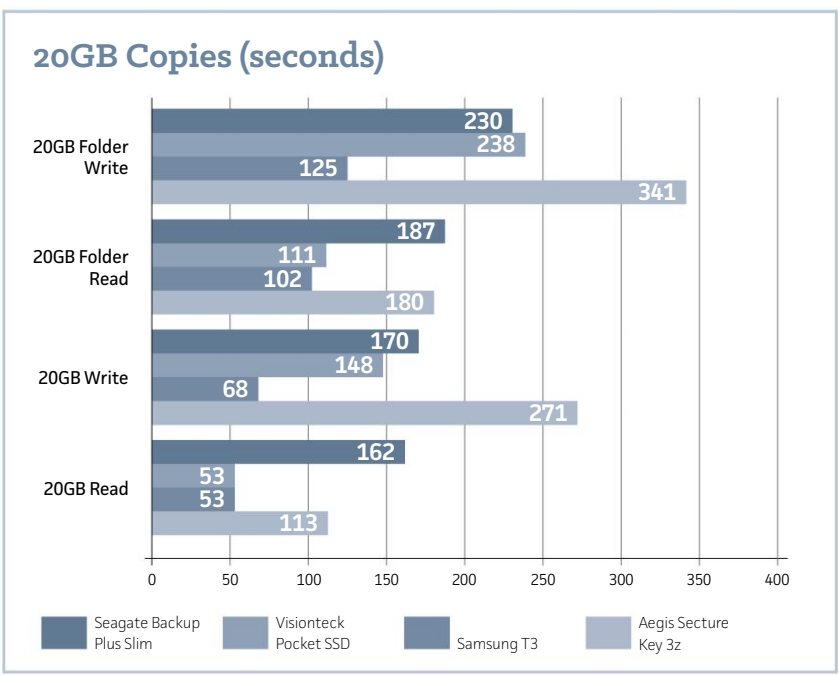
The 20GB read test took 1 minute, 53 seconds, or 176MBps, and the 20GB file-and-folder read test took 3 minutes flat, or 111MBps. It's not the Samsung T3, but the 3z is far more secure and easily fast enough for its intended purpose. Unless

your top-secret data is in the form of 2160p video, don't sweat it.

One thing about the Secure Key 3z, and many secure drives, is that it runs much warmer than a standard USB thumbdrive, as the encryption hardware uses a fair bit of juice. I experienced a strange, nearly hot sensation when I pulled the drive out of the port after writing a lot of data. The heat is not dangerous to the drive or your data as the brushed black-aluminum casing is the heat sink.

The Configurator

With an option known as the Configurator, you might think that Apricorn contracts Arnold Schwarzenegger to come to your home and provision your Secure Key 3z. Sadly, that's not the case. But this 10-port



This comparison isn't strictly fair, but it does show the relative performance against other USB options and the penalty AES 256-bit encryption imposes during writing.

USB 3.0 hub and software ease the chore of handling accounts and PINs for a fleet of Secure Key 3z's.

As you can see here, the ports on the Configurator are all on top in by far the most convenient location. The downstream port and power connector are on one end, and the whole deal is made of aluminum and is rather hefty. Despite that, it's only $99, which kind of surprised us since corporate-focused hardware tends to be a bit pricey.

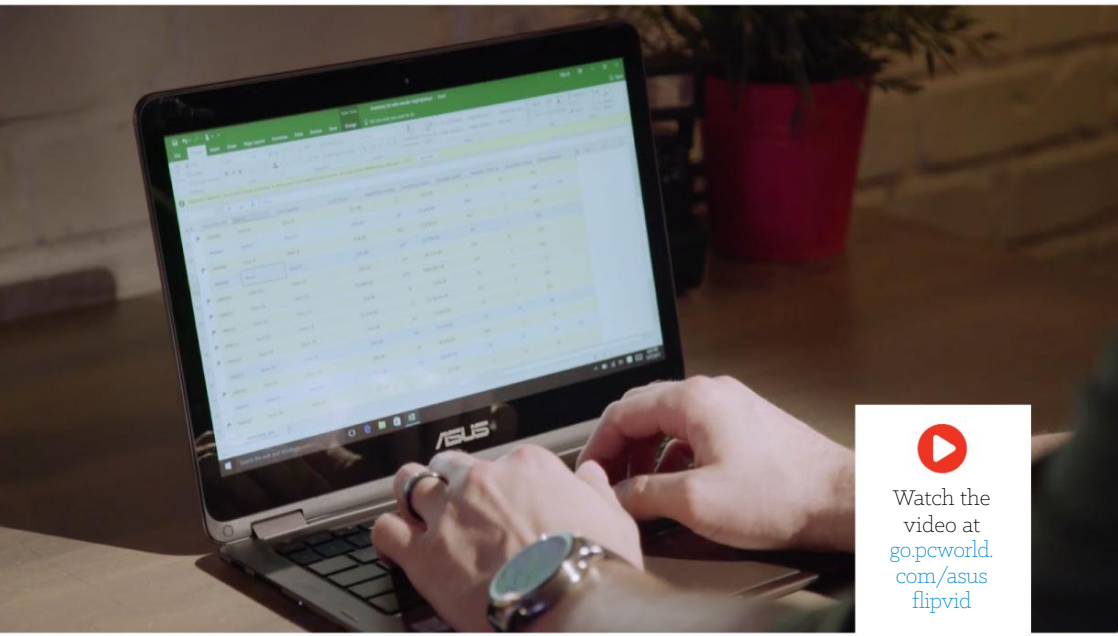
The software and surprisingly affordable USB Configurator hub allows IT departments to configure multiple Secure Keys at the same time.

Price and conclusion

For the security and cross-device compatibility it delivers, the Secure Key 3z is a bargain. It's not cheap by other standards, mind you: $79 for the 8GB, $99 for the 16GB, $129 for the 32GB, and $159 for the 64GB. But that's life in the secure-keypad lane. Obviously, the larger capacities offer a lower price-per-gigabyte ratio, but how much of your data really needs to be secured?

While the 3z doesn't really improve on its 3.0 predecessor's capabilities, the 3z is smaller, about half the weight, and appreciably cheaper—around $20 less for similar capacities. But the 3.0 is available in capacities up to 480GB as opposed to the 3z's maximum of 64GB.

We say save some bucks with the 3z unless you need the larger capacities. If you're worried about accidental key presses, don't be. The buttons are far too stiff for any but the most forceful contact, and even if an accidental press occurs, the odds of seven correct presses in sequence are astronomical. Overall, it's a nicely thought-out product.



Watch the video at go.pcworld.com/asusflipvid

Asus ZenBook Flip: A sleek, affordable 2-in-1 for everyday tasks

BY JOSH NOREM

THE ASUS ZENBOOK Flip has a cute name, and that's kind of the vibe we get from using it, too. At just $749, it's a notebook that doesn't try to be the most powerful or most advanced 2-in-1. Instead, the Flip (go.pcworld.com/asusflipamz) offers a slim and portable design that's easy to afford and easy to use.

Really, this laptop reminds us a little of the netbooks that existed

At the top of the bezel is a 1.2MP webcam.

about 10 years ago. However, unlike those painfully underpowered systems, the Flip's Core m processor can actually get work done. Storage is plentiful, too: Asus offers two versions of this 2-in-1, and they're essentially the same aside from the SSD. The base model comes with a 256GB SSD for $699, and the second model comes with a 512GB SSD for $50 more. Our review unit sported the 512GB drive, but our critique applies to both models.

Design

The ZenBook Flip's most notable feature is its incredible slenderness. At 0.54 inches thick and 2.8 pounds, this convertible is thinner and lighter than rival 2-in-1 machines, and it's effortless to carry around. The reason for its slim form is that Core m CPU, which sips just 4.5W of juice and thus doesn't require a fan. Competitors like Lenovo's Yoga 710 and 910 pack 15W processors.

Almost equally attention-grabbing is a 13.3-inch IPS panel with touch support. It looks semi-glossy to our eyes (even though Asus

Shown is the right side of the machine, which features a micro-HDMI, USB-C Gen 1, and USB 3.0 Type-A port. On the left side are a second USB 3.0 Type-A port, SD card reader, volume rocker switch, and power button.

labels it as “anti-glare”), offers wide viewing angles, and has a sharp picture with great colors. Overall, it’s higher-quality than we expected from a laptop at this price.

The Asus ZenBook Flip has a brushed-aluminum lid, but plastic everywhere else. That said, its 360-degree hinge is sturdy, showing no signs of flex when opening and closing the device.

By contrast, the island-style keyboard does flex quite a bit. Typing on it feels like banging on a cheap piece of plastic, though we love the fact that the keyboard offers full-sized Shift, Enter, and Backspace keys as well as separated arrow keys. Aside from the keyboard's flex, and the floaty sensation of the trackpad, the notebook feels well-made and more expensive than it actually is.

Ports and speakers

The ZenBook Flip has a terrific selection of ports, particularly given its diminutive size. You get two USB 3.0 Type-A ports (one of which allows charging even when the notebook is asleep), one USB-C 5Gbps port, a mini-HDMI port, an SD card reader, and a headphone jack. Asus also placed

a rocker switch on the Flip's left side for volume control, which is handy but can sometimes be awkward since it sits right next to the power button.

Two speakers underneath the Flip provide surprisingly good sound that's just loud enough without going overboard. They're sufficient for 99 percent of tasks, but folks who want a really loud notebook may still be disappointed when they need intense volume.

The guts

As mentioned, inside you'll find a Core m processor: a 6th-generation Core m3-6Y30 that runs on a very conservative 4.5W diet. Its lack of fans allows the Flip to run silently at all times, but that design does constrain performance.

The CPU comes paired with 8GB of LPDDR3/1866 RAM, a sufficient amount for the web browsing and office work this notebook was designed to handle.

Asus ZenBook Flip UX360CA-DBM2T

AT A GLANCE

The Asus ZenBook Flip might not be quite as elegant and powerful as its primary competition, but it costs a heck of a lot less and can still do the vast majority of the same workloads.

PROS

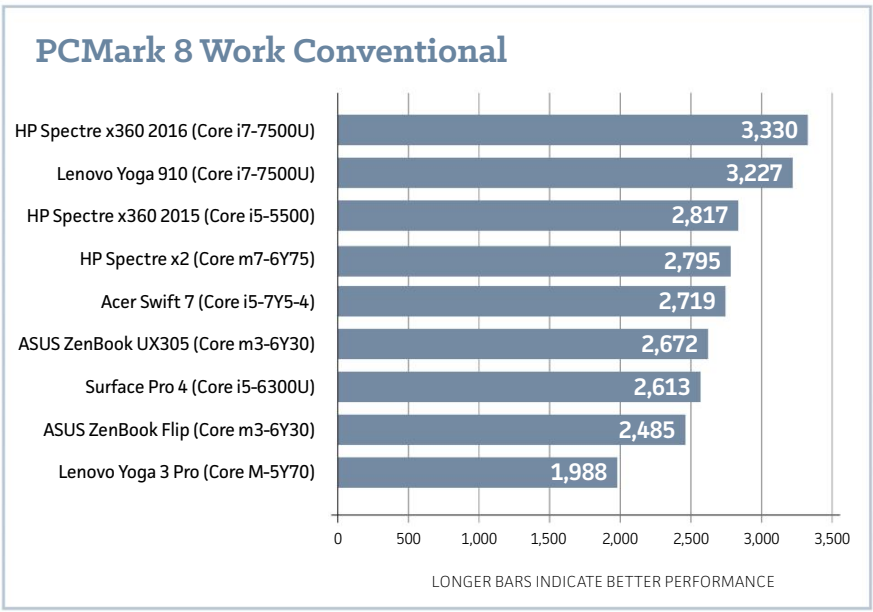
- Fanless design
- Very thin and light
- Snappy for everyday tasks..

CONS

- …but only good for everyday tasks
- Feels a little flimsy
- Trackpad feels floaty

$749

★★★★★



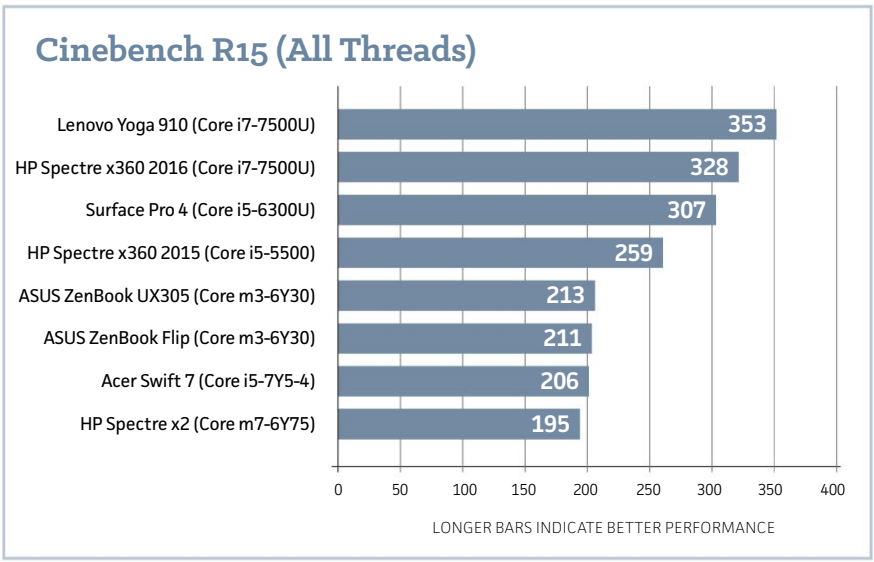
Storage comes in the form of either a 256GB or 512GB M.2 SATA 6Gbps drive, while an Intel dual-band chip provides 802.11ac and Bluetooth 4.1 support.

Performance

Nobody expects a notebook with a Core m processor to tear up the benchmark charts, but we were still quite curious to see how the Flip compared to its more expensive rivals. Let's see how its ultra-low voltage CPU did when put to the test.

PCMark 8

Most people use a laptop to do light office work, surf the web, and stream videos. To test how the Flip would survive in a cubicle farm, we fired up PCMark 8's Work Conventional test. It simulates a typical workload for a desk jockey: spreadsheet editing, document creation, video chatting, and web browsing.



Unsurprisingly, the Flip's 4.5W Core m CPU gets bested by the more powerful 15W chips in rival laptops, but it still turns in respectable performance. Anything that scores above 2,000 in this particular benchmark should handle daily office work without issue, and the Flip's result of 2,485 sails over that bar.

Cinebench R15

For our next benchmark, we turned to Cinebench R15. It stresses a processor by feeding off of CPU cores and clock speeds while rendering a 3D scene. Most ultraportable laptops will finish the task within a few minutes, making the results a good gauge of a processor's performance for short but heavy CPU loads.

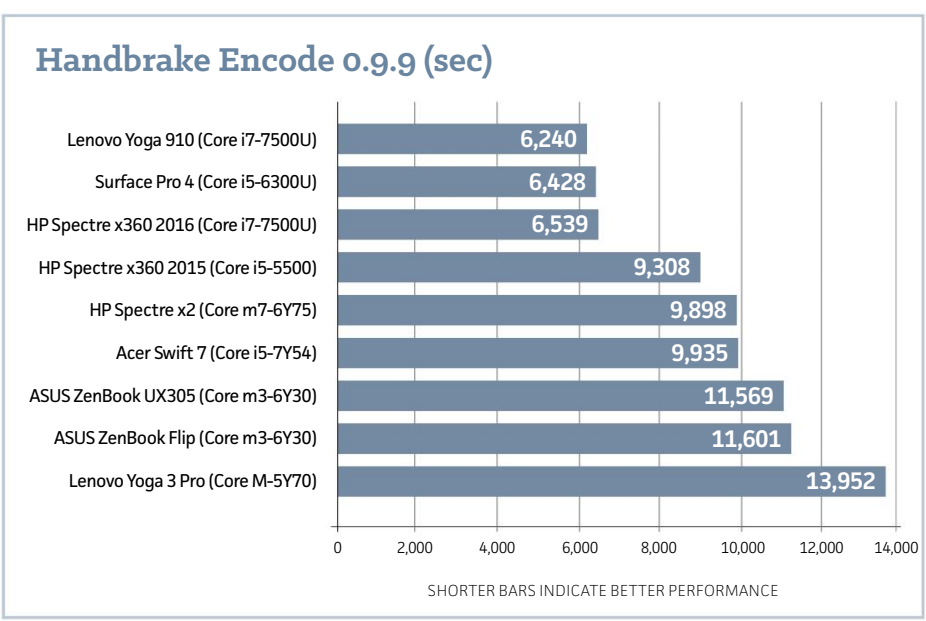
Surprisingly, the Flip wasn't at the bottom of the list. Among its Core m peers, its Core m3-6Y30 actually outperformed the Core m7-6Y75 in the HP Spectre x2, as well as the newer Kaby Lake Core i5-7Y54 in the Acer Swift 7. Our best guess for this outcome has to do with cooling and how much the Spectre x2 and Swift 7 throttle performance once their processors heat up.

Standing virtually side-by-side with the Flip is its non-touch, traditional-laptop sibling, the Asus ZenBook UX305 (go.pcworld.com/ZenBookUX305). That's not too surprising, since the two machines' specs are nearly identical, but it's nice to know you don't lose anything if you want a convertible instead of a standard laptop.

Handbrake Encoding

The one thing these CPU performance charts don't show is just how quiet and cool the Flip runs. Not directly, at least.

But that design does show its effect in our Handbrake benchmark. This real-world test involves converting a 30GB MKV file into a smaller MP4 using Handbrake's Android Tablet preset, and it hammers hard on a CPU. For space-constrained notebooks, running Handbrake is a torture test, and shows which manufacturers are willing to turn up the fans and preserve performance and which prefer to throttle down the power in favor of running cool and quiet.

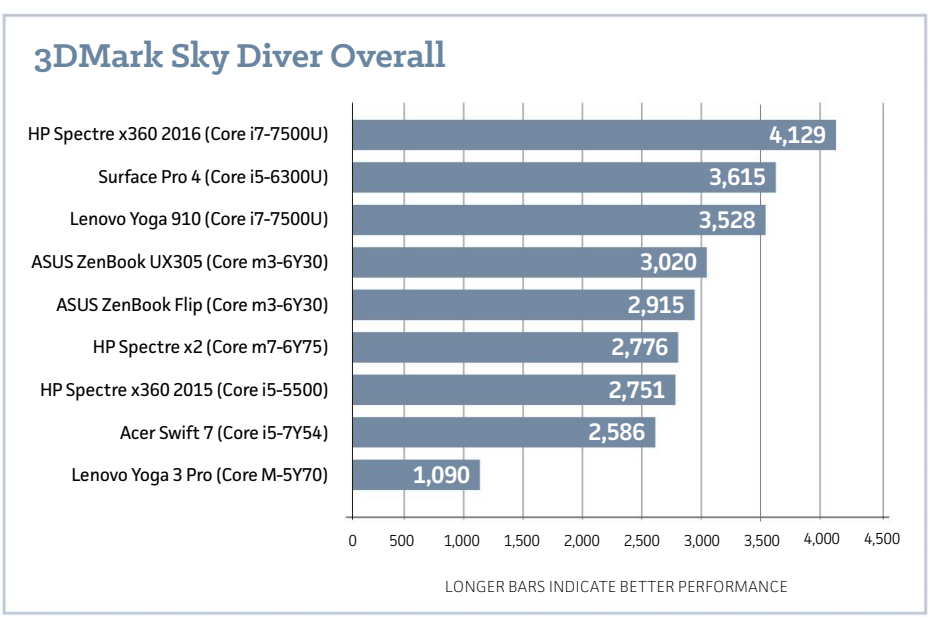


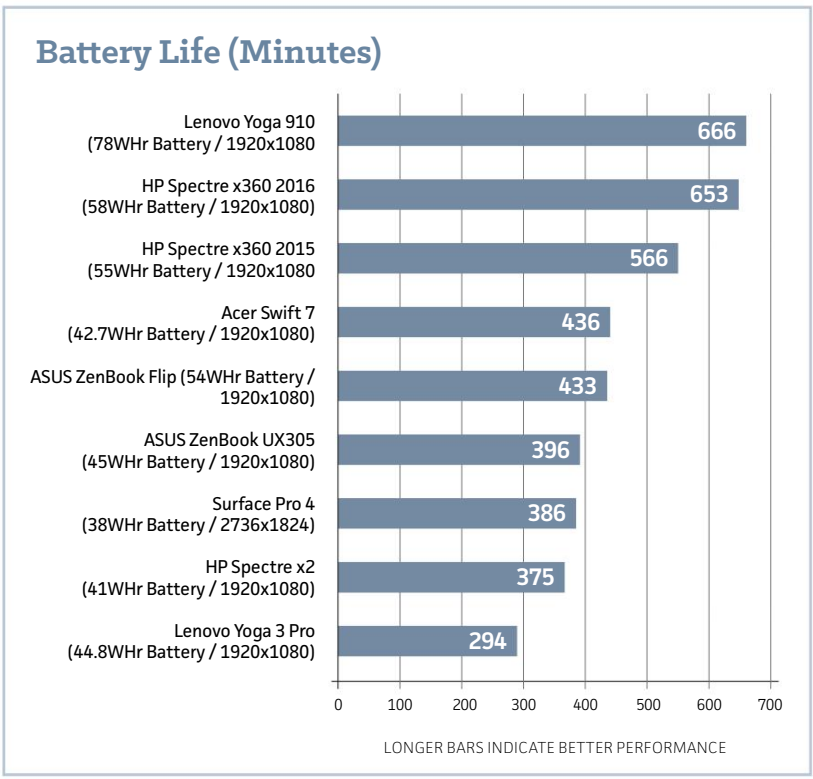
But, as we noted earlier, the Flip doesn't have any fans. So while this convertible scooted out ahead of the faster-clocked processors in the Spectre x2 and Swift 7 during our Cinebench benchmark, it fell behind the pack when tasked with converting a 30GB MKV file to a smaller MP4 using Handbrake's Android Tablet preset. Way behind.

The fastest laptop of the bunch, the Yoga 910, finished its task in about an hour and 44 minutes, while the Flip quietly grazed on the file for about three hours and 13 minutes (once again, roughly the same amount of time as the ZenBook UX305). The Spectre x2 and Swift 7, for their part, completed the benchmark in about two hours and 45 minutes.

3D Sky Diver

Nobody will buy the Flip to smash skulls in the trenches of *Battlefield 1*, but you might want to play light games on this laptop from time to time. To see just what we could get out of the CPU's integrated graphics, we fired up 3DMark's Sky Diver benchmark, a synthetic test





that simulates gaming at 1080p at roughly Medium settings.

Why Sky Diver, and not Cloud Gate, which tests at 720p? Well, mostly to show you just how much more the 15W parts can stretch their legs, even when also running integrated graphics. HP's current Spectre X360, a convertible laptop sporting Intel's latest dual-core i7 chip, manages to eke out a decent score. The rest of the notebooks in the chart are better off sticking to 720p and low-resolution graphics—and in lightweight games at that.

Battery life

In theory, with its low TDP processor, the Flip should outlast the rest of

its competition—but instead, it fell in the middle of the pack during our video rundown test. After queuing up a 4K-resolution movie in Windows 10's native Movies & TV application and letting it run with the screen set between 250 and 260 nits and volume at 50 percent, the Flip lasted for 433 minutes.

Seven hours and 13 minutes of playback isn't shabby, but both HP Spectre X360 models, which have roughly the same size batteries but more power-hungry CPUs, lasted even longer. The 2015 model got almost 9.5 hours of battery life, while the 2016 version lasted almost 11 hours. However, you do pay more for the Spectre X360. The ZenBook Flip also managed to last an extra half-hour over its traditional-laptop counterpart, the ZenBook UX305.

Conclusion

Despite falling in the middle or bottom of our benchmark comparisons, using the Flip is a really pleasant experience overall. It still feels snappy and can multitask well: When we had over a dozen tabs open in Chrome, including videos running on YouTube, we could still copy files to the SSD with no slowdowns.

Yes, it has shortcomings, but the're very tolerable. The Flip feels cheaper in places and more plastic-y (because it is), but it's also lightweight and thin, and boasts both a decent variety of ports as well as a cavernous amount of storage, plus a damned fine screen. For $749, it might not be quite as elegant and powerful as rivals like the Yoga 910 or HP Spectre X360, but it costs a heck of a lot less while still doing 99 percent of what the more expensive laptops can.

The new Dell XPS 13 Developer Edition is the little Linux laptop that can

BY ALEX CAMPBELL

INSTALLING LINUX ON a laptop is one of the biggest stumbling blocks to adoption of the OS. After all, taking a perfectly good PC, nuking Windows, and replacing it with an unfamiliar OS can seem a lot like

performing open-heart surgery to an inexperienced user. When you take into account that there are precious few laptops with Linux preinstalled, it's no wonder that desktop Linux adoption numbers are so grim. (There are other reasons too, but I won't go into those here.)

One of the few laptops to come correct with a Linux OS is Dell's XPS 13 Developer Edition (go.pcworld.com/xps13de). I got a chance to benchmark the 2015 model (go.pcworld.com/benchlnx) a few months ago, and really enjoyed playing with the little ultrabook. Physically, it's virtually identical to the consumer version of the XPS 13, only it came loaded with Ubuntu 14.04. Flash forward, and Dell has updated its Developer Edition with Intel's Kaby Lake CPU and Ubuntu 16.04. I have to say, there's not much to dislike about the revamp.

PCW Desktop Linux Test

	Dell XPS 13 DE 2015	Dell XPS 13 DE Kaby Lake	Dell XPS 13 DE Kaby Lake
Processor	Intel Core i7-6560U @ 2.20 GHZ (4 Cores)	Intel Core i7-7500U @ 2.70 GHZ (4 Cores)	
Motherboard	Dell 09JHRY	Dell 0839Y6	
Chipset	Intel Device 1904	Intel Device 5904	
Memory	1638MB		
Disk	435MB	THNSN5512GPUK NVMe Toshiba 512GB	436MB
Graphics	Intel Device 1926 (1050 MHZ)	Intel Kabylake GT2 3072MB (1050MHZ)	Intel Device 5916 (1050 MB)
Audio	Realtek ALC3246		
Network	Intel Wireless 8260	Qualcomm Atheros QCA6174 802.11ac Wireless	
OS	Ubuntu 14.04	Ubuntu 16.04	
Kernel	3.19.0-33-generic (x86_64)	4.4.0-59-generic (x86_64)	
Desktop	Unity 7.2.4	Unity 7.4.0	
Display Server	X Server 1.17.1	X Server 1.18.4	
Display Driver	Intel 2.99.917		
OpenGL	3.3 Mesa 10.5.9	3.3 Mesa 11.2.0	
Compiler	GCC 4.8	GCC 5.4.0 20160609	
File-System	ext4		
Screen Resolution	3200x1800		

Note that both of the Kaby Lake entries are the same machine. The one to the left was tested with an encrypted filesystem.

(If you're curious, Gordon Ung put a Core i5-equipped Windows model of the 2016 XPS 13 (go.pcworld.com/xps13rv) through its paces, too.)

Hardware changes

The move to Intel's Kaby Lake line of CPUs is the most notable hardware change in the new XPS 13. The model I tested came with an i7-7500U, which out of the box offers a 500MHz jump in base frequency over the i7-6560U Skylake-based CPU in the previous model, and 300MHz more in turbo frequency, while staying at a cool

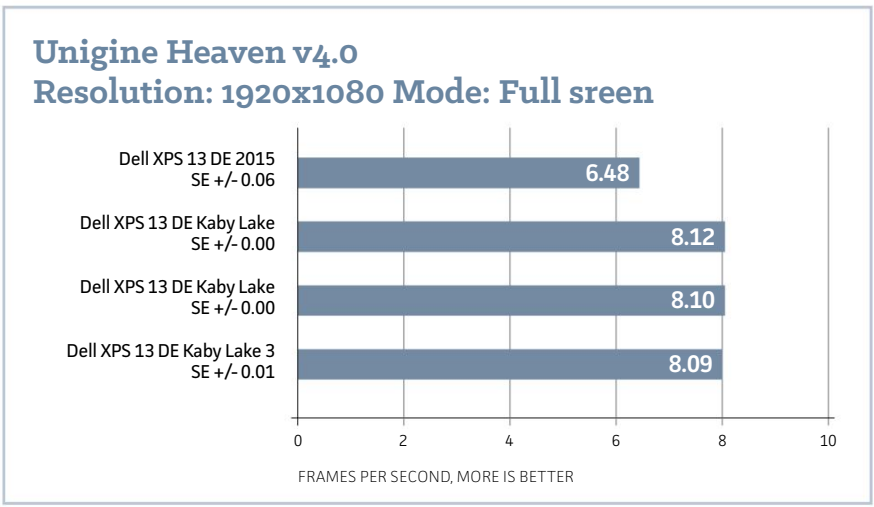
15W of TDP (or thermal output). What's interesting to note is that you get this extra power at the high-end with extra efficiency.

When the CPU isn't under heavy load, it's able to pull back on the throttle to save power. (This is called configurable TDP-down.) Using this technology, the 6560U in the previous model could be set to sip power with a TDP of 9.5W. The 7500U in the new model goes down

PCW Desktop Linux Test

	Dell XPS 13 DE 2015	Dell XPS 13 DE Kaby Lake	Dell XPS 13 DE Kaby Lake
iozone: Record Size: 1MB - File Size: 4GB - Disk Test: Read Performance	8725.48	8662.55	8552.13
iozone: Record Size: 4Kb - File Size: 4GB - Disk Test: Read Performance	7273.74	6986.04	7503.84
iozone: Record Size: 1MB - File Size: 4GB - Disk Test: Write Performance	1182.83	427.77	426.16
iozone: Record Size: 4Kb - File Size: 4GB - Disk Test: Write Performance	1150.55	415.69	431.41
iozone: Record Size: 64Kb - File Size: 4GB - Disk Test: Read Performance	8031.57	9494.78	9322.52
iozone: Record Size: 64Kb - File Size: 4GB - Disk Test: Write Performance	1155.54	414.04	432.15
unigine-heaven: Resolution: 1920x1080 - Mode: Fullscreen	6.48	8.12	8.10
1080p H.264 Video Playback (Avg)	7.92		6.99
ramspeed: Type: Add - Benchmark: Integer	1367.37	14187.94	14098.67
ramspeed: Type: Copy - Benchmark: Integer	14532.96	14782.52	14709.15
ramspeed: Type: Scale - Benchmark: Integer	14166.17	14697.88	14754.85
ramspeed: Type: Triad - Benchmark: Integer	13861.64	14142.73	14199.98
ramspeed: Type: Average - Benchmark: Integer	14116.91	14460.50	14480.28
ramspeed: Type: Add - Benchmark: Floating Point	15808.82	16039.90	16054.65
ramspeed: Type: Copy - Benchmark: Floating Point	14540.39	14720.75	14721.97
ramspeed: Type: Scale - Benchmark: Floating Point	14502.17	14749.52	14704.07
ramspeed: Type: Triad - Benchmark: Floating Point	15744.85	16033.30	1591.97
ramspeed: Type: Average - Benchmark: Floating Point	15136.73	15360.16	15382.89
x264: H.264 Video Encoding	93.03	92.30	99.29
build-linux-kernel: Time To Complies	254.87	225.00	224.27
compress-gzip: 2GB File Compression	12.64	10.91	10.91
encode-flac: WAV To FLAC	7.65	5.74	5.73
gnupg: 1GB File Encryption	8.52		

An overview of the benchmarks that were run. Note that the third and fourth columns are the same machine, but the third column represents the XPS 13 with its storage encrypted.



Unigine Heaven performance in frames per second.

even further to 7.5W, netting 2W of efficiency.

The other big hardware shift worth noting is the move away from Intel's Wi-Fi to Qualcomm's. The previous model had an Intel 8260 wireless card, for good reason: Intel's Wi-Fi implementations have been well-supported in the Linux kernel for some time. And that's no small thing. Wireless hardware support on Linux was still a headache as recently as 2014 (and a target of ridicule from Windows users I know), which made hardware (read: laptop) selection a big deal back then. Seeing as the older XPS 13 model shipped with Ubuntu 14.04 and the 3.19 kernel, the Intel wireless card made sense.

The new XPS 13 ships with Ubuntu 16.04 and the 4.4 kernel. The Linux 4.4 kernel has better support for the ath10k driver, which opened more choices for Dell, hence Qualcomm's Atheros QCA6174. Unless you're getting a really exotic laptop, there's a very good chance that any laptop you buy has either a Qualcomm or Intel Wireless chip in it. Improved support for newer Qualcomm hardware means that Linux users can feel a lot more confident in their choices of wireless hardware.

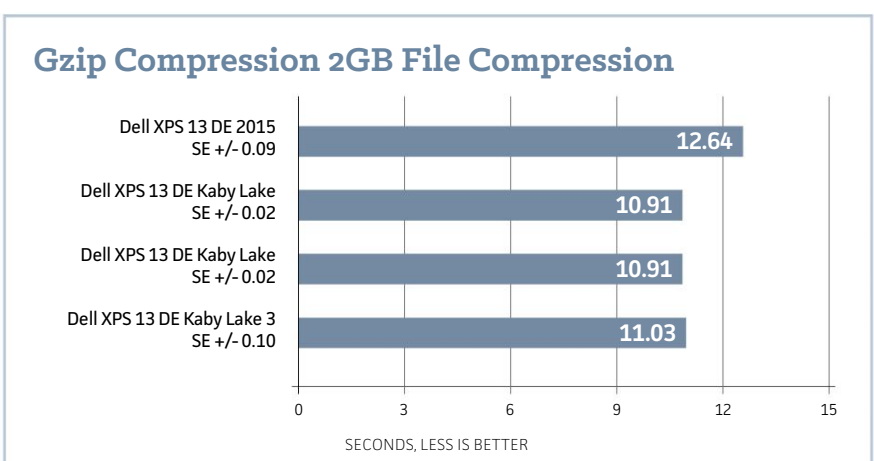
Benchmarks

When it came time to test the new XPS 13, I opened up Phoronix Test Suite to run the same tests (go.pcworld.com/benchlnx) I did with the 2015 machine. In just about every test, the Kaby Lake model outperformed its Skylake-based sibling, as should be expected given the extra 300MHz it has to work with in its turbo range.

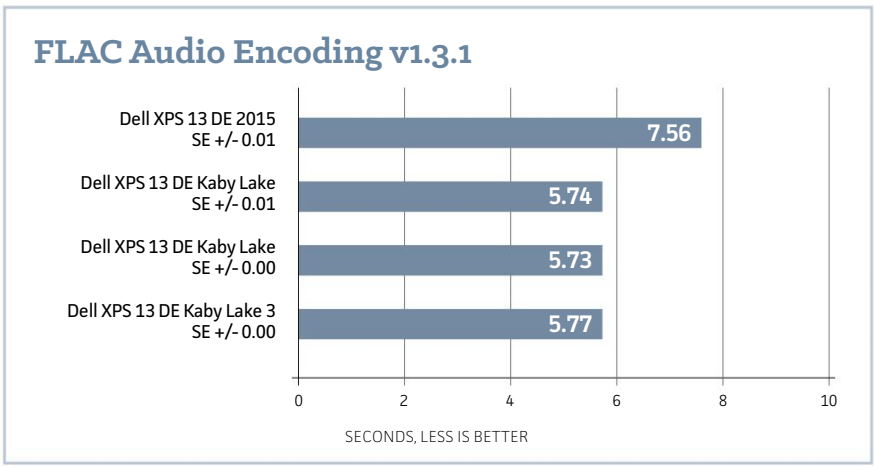
I was most surprised by its performance in Unigine Heaven, which tests game-like graphics rendering.

I was most surprised by its performance in Unigine Heaven, which tests game-like graphics rendering. (For the record, 3DMark is DirectX-based and won't run natively in Linux.) The XPS 13 is not billed as a gaming PC, and only managed 8.1 frames per second on average in my testing. As bad as that sounds, that's about 2.3 frames per second faster than the older model. What's surprising here is that the i7-7500U's integrated graphics are inferior to the i7-6560U's on paper. (The 7500U has HD Graphics 620, while the 6560U has Iris Graphics 540.) I also noticed that the actual render quality of the 7500U had fewer errors and looked a lot better.

In more mainstream computing tasks, the updated XPS 13 did very



Gzip compression completion time in seconds.



FLAC encoding time in seconds.

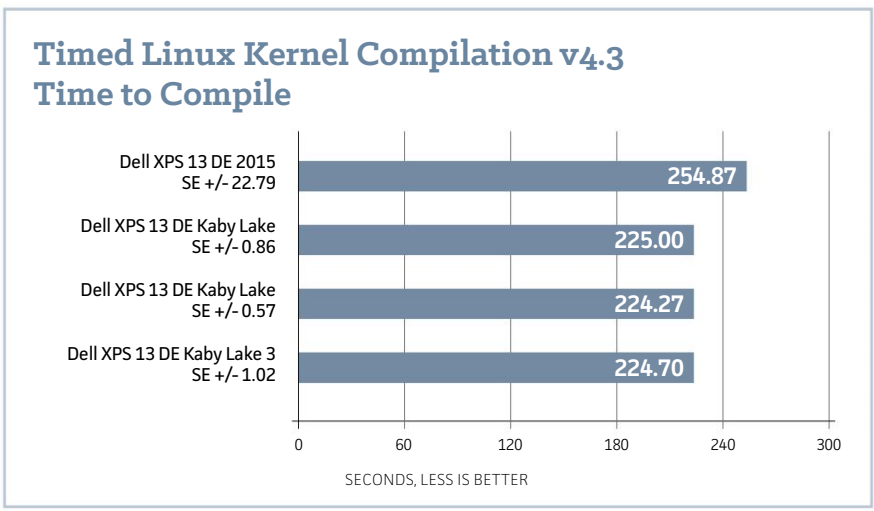
well. While playing (decoding) H.264 video, the new XPS 13 had slightly less CPU utilization than the previous model. When encoding, the two CPUs performed about the same.

In number-crunching tests, the Kaby Lake CPU showed some really good numbers. The laptop compressed a 2GB file with Gzip about 12.7 percent (around 2 seconds) faster than the previous model. Compiling the Linux kernel and encoding a WAV file to FLAC was 12 percent (about 30 seconds) and 25 percent (about 1.9 seconds) faster, respectively.

I ran a basic battery rundown test as well by playing a 1080p H.264 file on a loop with VLC. On the first run, I left the brightness at full (about 400 nits). Even with the screen pushing out photons at full power and the Wi-Fi enabled, the battery held out for 321 minutes (about 5 hours, 21 minutes)—nothing special, but long enough for a flight from Los Angeles to Atlanta. I ran the same test again with PowerTop installed and the screen brightness reduced by half (about 200 nits), which yielded 392 minutes (about 6 hours, 32 minutes), or an additional hour of time. At 200 nits, the screen is still plenty bright, and could be usable at even lower settings.

You can get yet longer life by enabling screen dimming and other

power-saving options if you like, but I turned off those options for testing. (It's a bit pointless to run a movie on loop with the screen dimmed or turned off.) I also had to keep the Wi-Fi radio up and running for the test, which was run by having another PC ping the XPS 13 until its IP became unreachable.



Linux kernel compilation time.

Conclusion

One of the great things about Linux is that you can run it on old hardware. But that doesn't mean Linux users can't have great new PCs too. The Dell XPS 13 Developer Edition is a fantastic little PC that is a joy to work on, and is designed to run Linux. If you've wanted a Linux laptop but can't stand fighting with unsupported hardware, the XPS 13 is the best (dare I say, only?) Linux laptop you'll find from a mainstream manufacturer.

While the Skylake-based XPS 13 from a couple years ago is still a great PC, the 2016 model offers a little more efficiency and power in the same package.

EVGA's sensor-laden iCX technology revolutionizes graphics card cooling

BY BRAD CHACOS

GRAPHICS CARDS AREN'T what they used to be—and that's a good thing. Nvidia's ferocious GeForce GTX 1080 (go.pcworld.com/gtx1080rev) blows the pants off its predecessor in sheer, overwhelming performance while actually drawing slightly less power, and generating only slightly more heat overall. But here's the thing about traditional video cards: A single sensor on the graphics processor determines how cooling is handled for the entire board.

The EVGA GTX 1080 Superclocked 2 with iCX cooling technology.

That's bad, popular hardware maker EVGA says, because the "Pascal" GPUs inside the GTX 10-series are so power-efficient that a graphics card's memory and voltage controllers actually generate more heat than the GPU itself. So, EVGA's rolling out a revolutionary new "iCX" graphics card cooling solution that relies on not one, but ten different sensors to monitor and intelligently adjust how each and every part of the board dissipates heat.

The fancy new tech is debuting in several of EVGA's GTX 10-series models (go.pcworld.com/evgaicx), which we'll dive into in more detail later. EVGA sent PCWorld one of its new GTX 1080 Superclocked 2 graphics cards (go.pcworld.com/gtx1080ftw)—a cousin to the beastly GTX 1080 FTW that we loved so much—and an updated version of its Precision XOC software (evga.com/precisionxoc) so we could dig deeper into the iCX cooling technology. Let's go!

The story behind the story: The inspiration for EVGA's iCX cooling actually comes from a scandal surrounding the GTX 1080 FTW (go.pcworld.com/gtxpads) late last year. The Internet rioted when several of the cards died in explosive fashion.

EVGA GTX 1080 FTW

AT A GLANCE

This is the GeForce GTX 1080 you've been waiting for. The EVGA GTX 1080 FTW puts EVGA's personal touch on Nvidia's beastly card, and it's a winner, from its high base clock and custom cooling to its extra 8-pin power connection.

$679

★★★★½

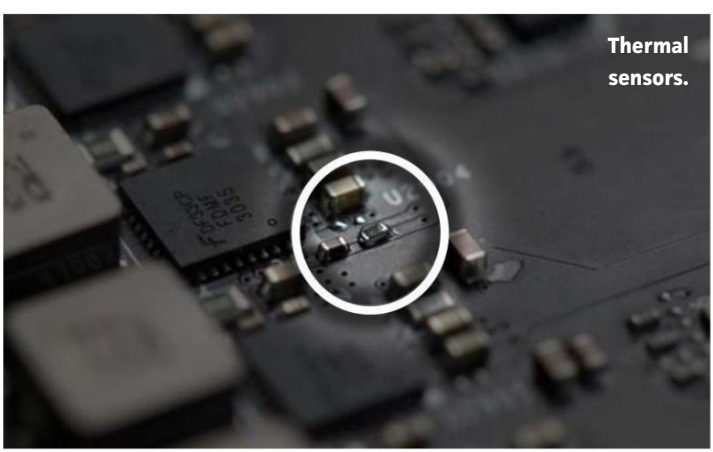
Subsequent sleuthing revealed that the hardware lacked cooling on its voltage regulator modules. EVGA acted quickly, offering free thermal pads and pushing out a BIOS update that increased fan speeds to lower on-board temperatures. Even though an internal investigation proved that the EVGA GTX 1080 FTW wasn't failing at a higher rate than previous-gen graphics cards, the tempest provoked EVGA to examine how graphics card cooling works in the Pascal era.

"That really opened our eyes to take a deeper look at cooling on cards, and how we can improve the efficiency overall of cooling," EVGA product manager Jacob Freeman said in a phone interview. "If you only focus on the GPU temperature, then you're really neglecting all the other components of the card, which would still run really hot. On the flip side, if you focus on those other components, then you're not offering the best noise level possible, because the GPU doesn't really need the fans to spin that fast."

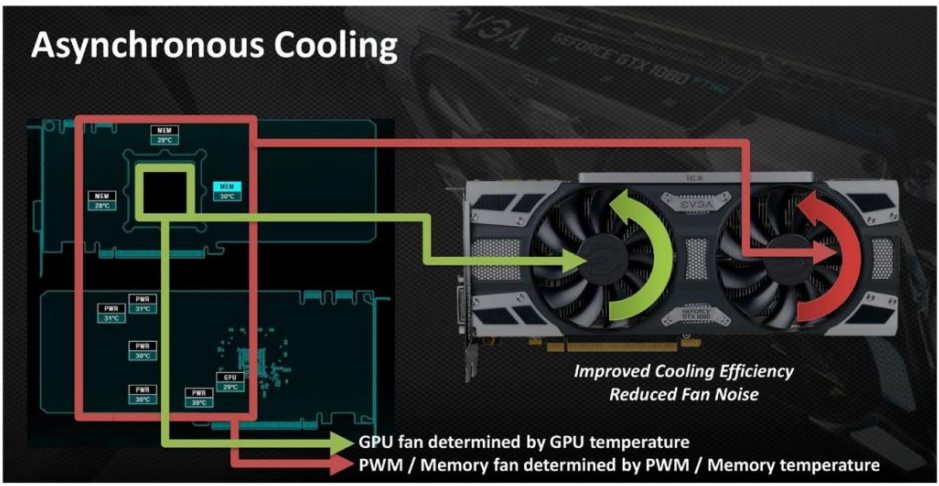
Getting granular on graphics temps

The solution to the problem? Sensors, sensors everywhere.

EVGA's iCX cooling technology still includes a traditional GPU temperature sensor, of course, but it adds nine additional ones—a sensor for the rear of the GPU, three for the graphics card's memory modules, and five for the power controllers. You can monitor them yourself, too. The updated version of Precision XOC shows the average temperature for each hardware category in its main interface, or you can see the



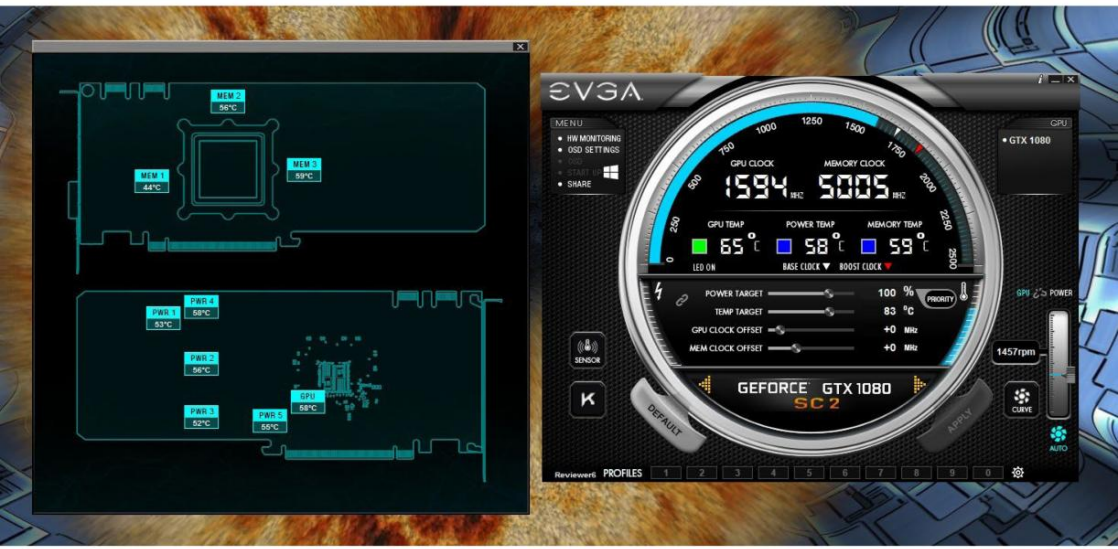
Thermal sensors.



temperatures for each and every sensor by clicking the newfound Sensor icon, which will cause a secondary window to open.

Those sensors affect how the two fans on the front of the graphics card behave. Unlike most video cards, which run their fans in tandem based on the temperature of the graphics processor alone, the EVGA GTX 1080 Superclocked 2 (like all iCX-equipped EVGA models) dedicates the left fan to cooling the GPU, and the right fan to cooling the memory and PWMs. Each fan changes speed dynamically to react to the temperatures being put out by those individual elements of the GPU. If the memory's heating up rapidly but the GPU itself is staying relatively cool (as was the case when I ran the Furmark torture test on the card for an extended period), the dedicated GPU fan maintains a slower—and thus quieter—speed, while the memory fan ramps up.

It's another lesson learned from the GTX 1080 FTW's overheating fiasco from late last year. The BIOS fix EVGA pushed to compensate for the lack of VRM cooling simply kicked both fans up a notch, and as a result the card wound up running louder, GamersNexus tests (go.pcworld.com/gnevgatest) revealed. The improvements offered in iCX's asynchronous cooling addresses that design quirk and lets EVGA eat its cake and have it



too. Precision XOC allows you to set custom, individualized fan curves for both the left and the right fan if you want to get fancy.

In my tests with the stock fan curve profiles, the iCX-equipped GTX 1080 Superclocked 2 ran noticeably quieter than the older EVGA GTX 1080 FTW, which uses the company's original ACX 3.0 cooling solution. The main GPU temperature topped out at 69 degrees Celsius running a lengthy Furmark test, a full 8 degrees lower than the 1080 FTW—though it's important to note that comparing the GTX 1080 Superclocked 2 against a heavily overclocked GTX 1080 FTW is far from an apples-to-apples comparison. Nor am I equipped to test the heat output from the older GTX 1080 FTW's memory and PWMs, which is a major point of iCX. (PCWorld's FLIR thermal imaging camera is in our San Francisco office; I work from New England.)

EVGA has all of the required testing equipment on hand, however. The company says that in its tests, the iCX cooling solution drops the main GPU temps by a few degrees, but other parts of the board see even bigger benefits—up to a 5- or 7-degree temperature decline in some components. That's huge.

Update: JayzTwoCents (youtu.be/5U-OCvcV7Yw) tested the iCX-

Precision XOC's new Sensor interface lets you see the exact temperature of each sensor on your EVGA iCX graphics card.

equipped EVGA GTX 1080 FTW 2 with a thermal camera, applying both an overclock and custom fan curves, comparing EVGA's new card against the GTX 1080 FTW with ACX 3.0. It's a great video that's well worth watching, but tl;dr EVGA's iCX technology functions as promised.

Even niftier, you can see the effects of iCX with your own eyes. The side of iCX-equipped models display separate RGB lights labeled G, P, and M, for the GPU, PWMs, and memory. The color of each indicator depends on how hot each type of hardware is running. A blue light means everything's nice and cool, a green light means you're actively using the graphics card but temperatures are in the safe range, and red means *danger, Will Robinson*!

Watching how the iCX technology affected the GTX 1080 Superclocked 2 as it hummed along in *The Division*

iCX Technology Improvement

EVGA's in-house tests showing the granular temperature differences between iCX- and ACX-equipped Superclocked graphics cards.

Component	EVGA iCX (SC2) Fan-1400/1600 RPM	EVGA ACX 3.0 (SC) Fan-1600/1600 RPM
GPU	64° c	67° c
GPU (Back)	69° c	70° c
Memory 1	81° c	85° c
Memory 2	74° c	81° c
Memory 3	55° c	61° c
Power 1	82° c	86° c
Power 2	76° c	81° c
Power 3	81° c	86° c
Power 4	76° c	79° c
Power 5	73° c	77° c

The iCX LED indicators on the side of the EVGA GTX 1080 Superclocked 2.

The EVGA GTX 1080 Superclocked 2's backplate.

wasn't it just insightful, it was *fun*—and I dig how EVGA managed to use RGB lighting for a practical purpose rather than simple aesthetics.

Diving into the new "Thermal LED" tab in Precision XOC's options lets you fine-tune the temperature ranges for each RGB indicator, as well as alter the color for every stage of each indicator.

Redesigned hardware

The sensors, fans, and RGB lighting is just part of iCX. EVGA's radical cooling solution also overhauled the design of the cooler itself to keep your graphics card running cool.

Both the baseplate and the backplate were designed to come into contact with all the crucial components of the card, allowing them to serve as quasi-heatsinks. Raised bumps on the backplate help add to the overall surface area, helping with heat dissipation, while numerous cut-outs help airflow through the body of the GTX 1080 Superclocked 2.

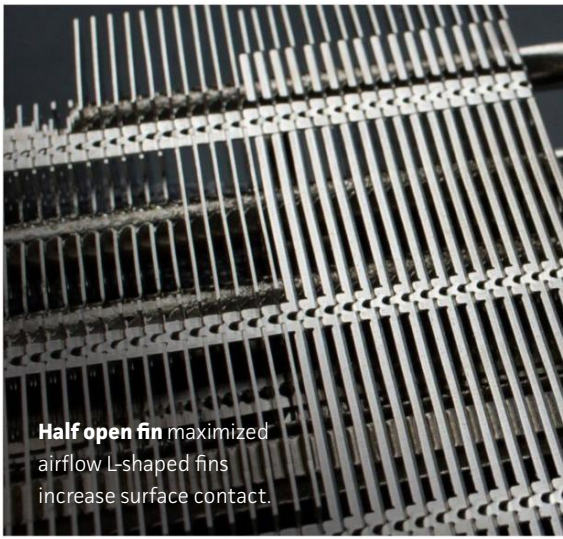
Tiny "fin pins" on the interior baseplate offer the same advantages as the backplate's bumps.

The *actual* heatsink inside the card, between the graphics processor and the fans, has also been tweaked to optimize airflow. The fins were

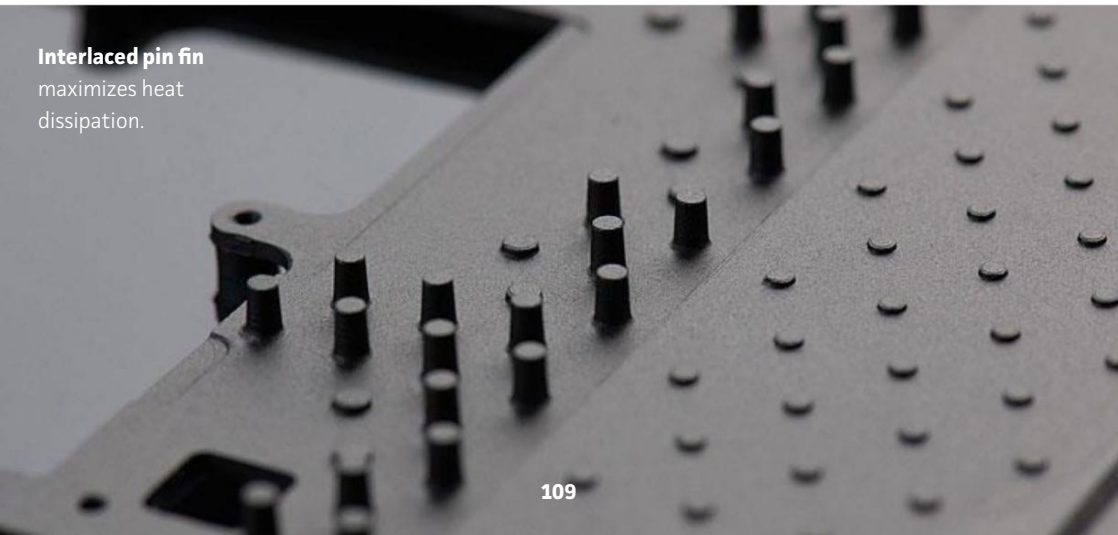
refined both to provide more contact surface and achieve better airflow, and they were also perforated with tiny holes to allow air to flow horizontally throughout the card.

I asked Freeman if that reduced surface area harmed the cooling endeavor. He said that the increased airflow more than makes up for it,

Fin holes direct airflow through fins.



Half open fin maximized airflow L-shaped fins increase surface contact.



Interlaced pin fin maximizes heat dissipation.

The iCX safety fuse.

pointing to the temperature comparisons shown previously as evidence.

Finally, iCX adds a unique safety feature inspired once more by the overheating debacle: An integrated safety fuse designed to protect your card in case that 0.01 percent chance of a catastrophic failure actually strikes. You'll still need to send your card back to EVGA for an RMA if the fuse blows—but it'll protect the core components of the graphics card from suffering a fiery death and possibly affecting the other hardware in your system.

Part of the family

One thing decidedly lacking in this write-up: Gaming performance results. I received my review sample from EVGA, in the midst of a New England blizzard that was causing my power to flicker—not exactly the ideal testing scenario. And as I said, comparing a beastly FTW model against the less-beastly Superclocked version isn't apples-to-apples.

But it's not a major concern anyway, as Freeman says the iCX cooling technology isn't likely to provide much in the way of raw performance gains. Instead, the goal was to provide a more holistic and granular approach to cooling in order to drive down both temperatures and fan noise across all areas of the hardware—which it appears EVGA has succeeded in doing. I loved the ACX 3.0 cooler on the original GTX 1080 FTW (go.pcworld.com/1080ftwrev), and the iCX cooler on the GTX 1080 Superclocked 2 is even better. Freeman also says the enhanced cooling may increase the overall lifespan of iCX graphics cards, though that's borderline impossible to test.

Intrigued? EVGA's launching iCX-equipped models of its GTX 1060, GTX 1070, and GTX 1080 graphics cards, albeit in limited quantity

The EVGA GTX 1080 Superclocked 2 looks very similar to the ACX-equipped version on the surface, but the lip on the top says "iCX" in tiny letters. It's also heavier and feels dense.

initially. EVGA's existing lineups with ACX 3.0 cooling will remain, but models with the iCX cooling solution will carry a "2" designation after their name, and iCX branding on the front of the box. For example, the GTX 1080 FTW will still pack an ACX 3.0 cooler. If you want the iCX variant, you'll need to pick up a GTX 1080 FTW 2.

The extra sensors, swanky RGB indicators, redesigned hardware, and fancy fans don't come for free. Freeman says EVGA's iCX graphics cards (go.pcworld.com/evgaicxcrd) will carry a premium of roughly $30 over their ACX-packing counterparts. EVGA's also launching a new step-up program where existing GTX 10-series owners can trade in their ACX 3.0-equipped graphics card for an iCX version for $99.

That's nothing to sneeze at. I'm guessing many people won't be interested in spending that sort of scratch for minimal performance gains, especially since EVGA's stock ACX 3.0 cooler already does such a bang-up job. This new iCX technology feels like a glimpse into the future, but I'm not sure how enticing it will be in the present, arriving nearly a year after the GTX 10-series launch.

On the other hand, EVGA's iCX is more comprehensive than any other air-cooling solution you'll find on the market today and a stunning response to the overheating fiasco (that wasn't). The iCX technology's cooler, quieter peace of mind may well be worth the upcharge for some folks. Overclocking and aftermarket water-cooling enthusiasts will likely adore the level of information EVGA's new cooling technology provides.

And those RGB temperature indicators are just plain *badass*.

Hands-on: Running Android apps on a Chromebook could be the best of both worlds

BY MELISSA RIOFRIO

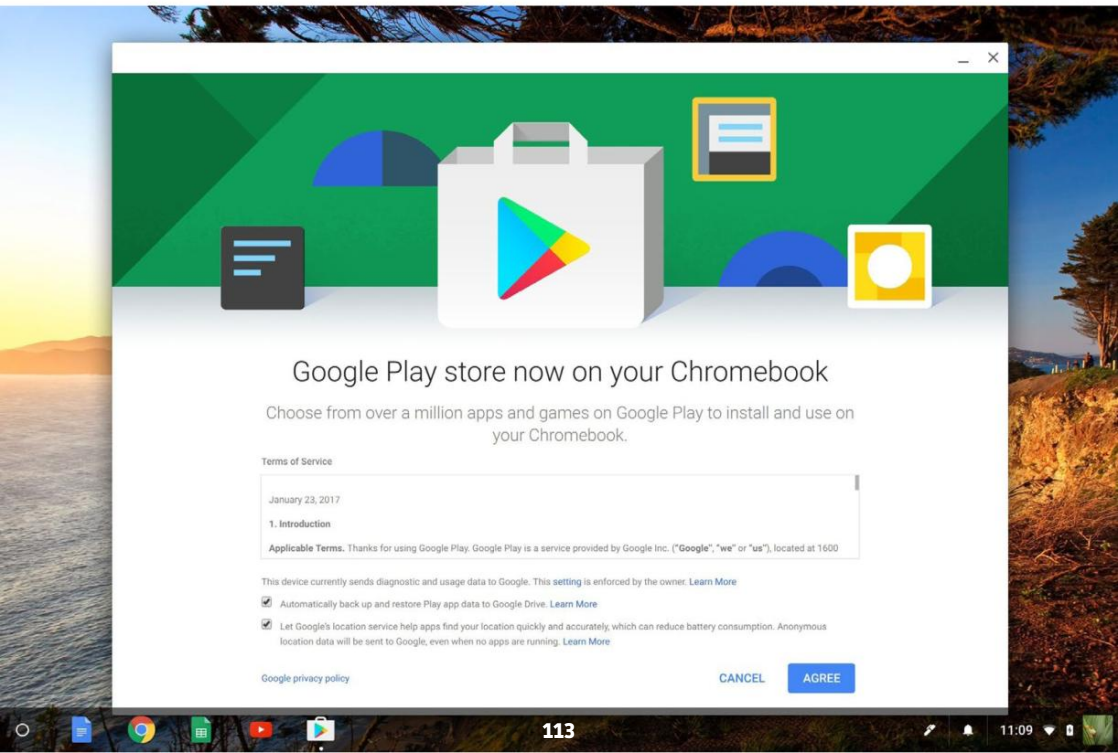
GOOGLE WANTS RUNNING Android apps on a Chromebook to feel natural, and to do that, it needs to convert someone like me—someone who's consciously avoided Android's legendary (go.pcworld.com/andrdmalw) malware problems. The better fit for me has been the serenity of Chrome OS, with its regular updates, innate security

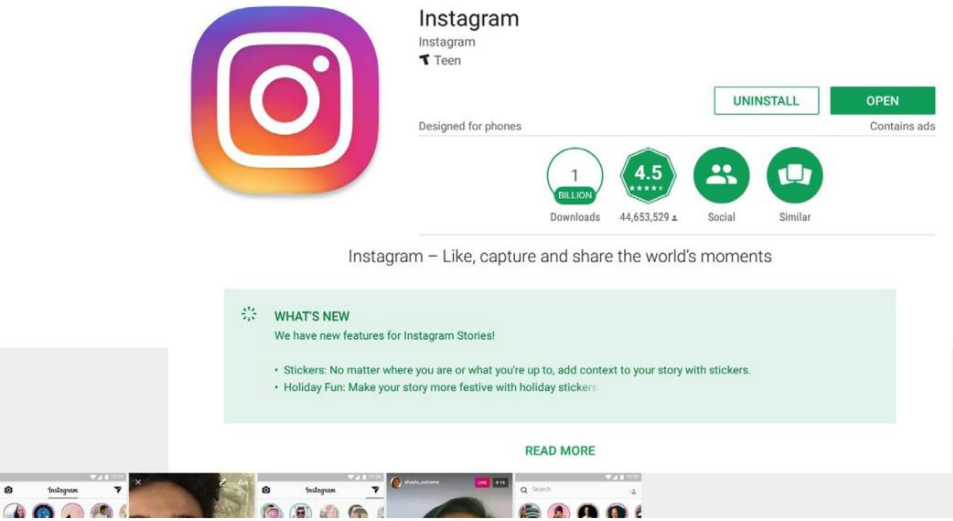
(go.pcworld.com/chrmbksec), and easy recovery tools. That's why I tote my Chromebook (go.pcworld.com/chrmbkexile) everywhere.

Android apps are coming to Chromebooks this year, though, and the truth is, they need each other. Chromebooks have had mainstream and vertical success (especially in schools), but with few native apps they're stuck in browser-land. Meanwhile, Android is straining to escape the confines of mobile devices (the few PC-sized Android devices haven't taken off).

Putting Android apps on a Chromebook could be the best of both worlds, and Google is working hard (go.pcworld.com/andrdphmal) to ensure that by taking steps to clean up (go.pcworld.com/securfix) its app store and encourage support for bigger screens. My mission was to see how this melding of ecosystems would feel for a daily Chromebook user. Just remember that Android app support is still in beta on Chrome OS, and even the Samsung Chromebook Pro I used is

Google's Play Store is ready to embrace Chromebook users, who will suddenly have access to millions of apps.





a prototype (due to ship in late April for $549). Things will likely change—but this is a first taste of an expanding world.

Instagram's Android app is designed for phones. On a Chromebook, it sticks with a smartphone-sized window.

Leave the phone, take the Chromebook

I hate trying to do anything useful on my smartphone. Even if it were phablet-sized, I'd still grumble as I squinted at tiny text and slid my fingers around some glassy keyboard impostor. I'm looking forward to using Android apps on a Chromebook simply because I'll be able to type more or less normally (although the Chromebook Pro's eentsy Tab and Backspace keys are already bugging me.)

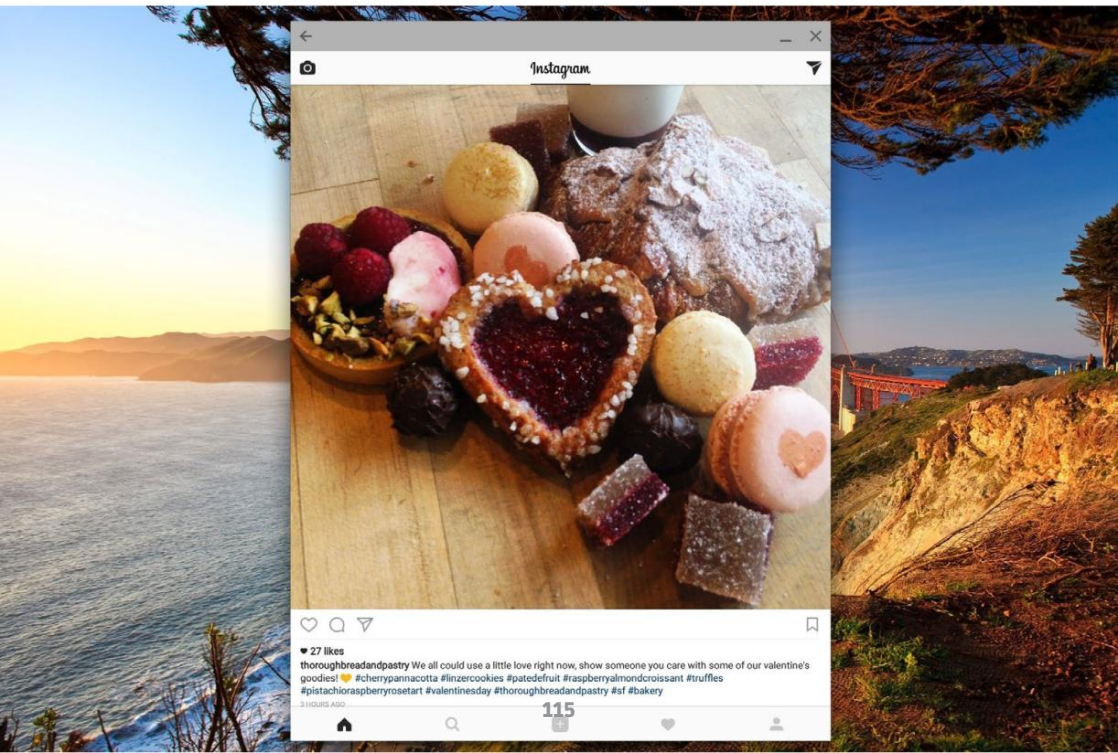
The Samsung Chromebook Pro offers a first for Chromebooks: an integrated stylus for writing and drawing on a touchscreen. I loved this on Lenovo's Yoga Book (go.pcworld.com/yogabkrev) (which has an Android cousin go.pcworld.com/yogabkrevgb) and expect to feel the same about it on Chrome—and oh yeah, Android. The stylus needs no batteries. It slips into a spring-loaded bay and can juggle functions like laser pointer and text selection via its own menu in Chrome's app tray. It's very small and skinny, though, which means it's better suited for jotting notes than penning your next Medium post.

The Chromebook Pro has a 360-degree hinge, so I can flip it around and suddenly have a Chrome tablet. The hard keyboard disables itself once the hinge exceeds 180 degrees, and an onscreen keyboard pops up when needed.

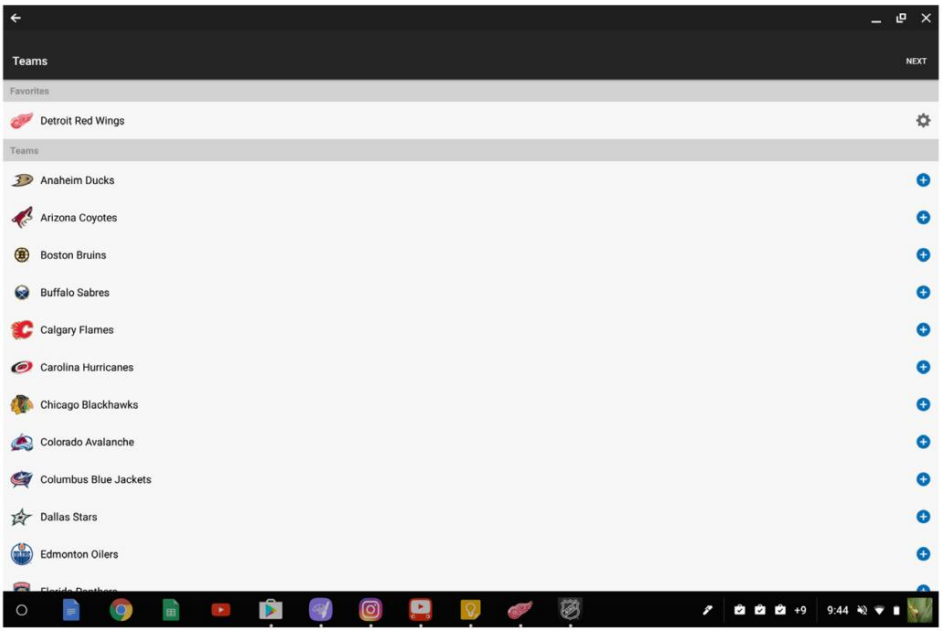
Despite my professed need for safety, the first thing I did was go off the reservation. Google provided a list of apps we could try, but it lacked the one I really wanted: Instagram. I went to the Google Play Store (after going through a few signup steps), found the app, and installed it. All apps are accessible through Chrome's App Launcher. Active apps' icons sit on the App Shelf that runs along the bottom of the Chromebook's display.

When a app isn't ready for the big screen

Chromebooks will be able to run any Android app, but some apps, like Instagram currently, will say "Designed for phones" on the app's



Instagram's Android app stays smartphone-sized on a Chromebook display, but such a visual app deserves more space.



download screen. That means when you launch it, it may look like a smartphone-sized window on your Chrome desktop.

Instagram worked fine. I could scroll with my finger, the stylus, or the trackpad (though the app seemed more finicky about the latter method), use the app controls, and even take a photo with the Chromebook Pro's integrated camera. I wish I could have expanded this richly visual app to fill my display.

On the other hand, if the app supports bigger screens simply by stretching to fit the space, you can get clumsy interfaces like the NHL app for the Detroit Red Wings shown above...

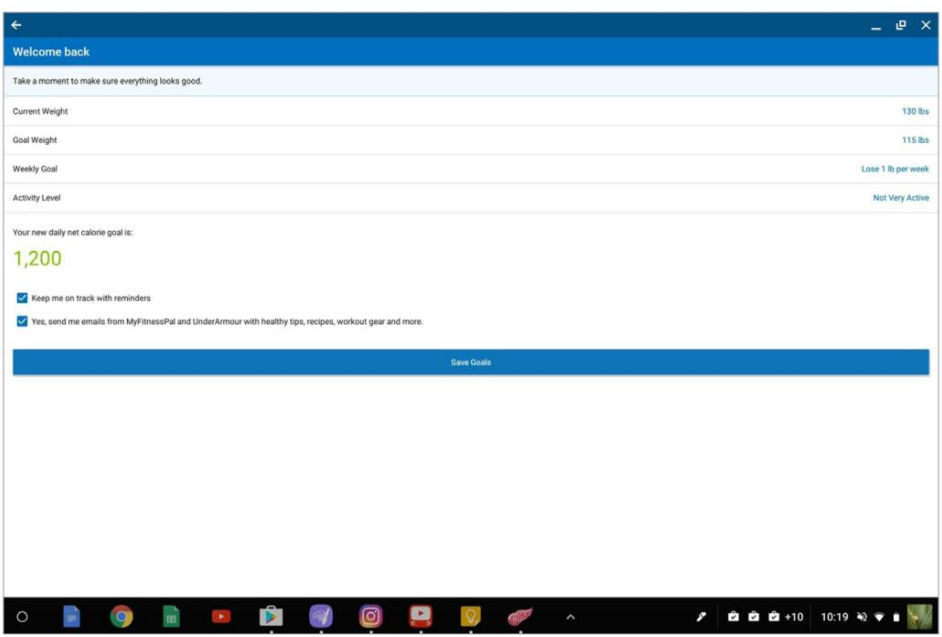
...or this UnderArmour fitness app here. Using either app on a Chromebook feels like watching a tennis game.

I kept downloading. Here's another thing to keep in mind: Apps take up space—especially games—and some Chromebooks skimp on storage. The Chromebook Pro's 32GB is less than most people get on their smartphones. Don't go crazy if you don't have the capacity.

Not all Android apps stretch well onto a wider screen, as this NHL app for the Detroit Red Wings shows.

Turning to the apps that were ready for Chrome-time, I started with Asphalt 8, an Android racing game. It took up 1GB of internal storage (gulp). It ran full-screen and worked best in tablet mode, so I could hold the Chromebook Pro as if it were a steering wheel (it has an accelerometer and gyroscope), and tap one side of the screen for brakes, the other for speed. I wrecked my car a zillion times as I careened around the game's environment—I can't blame that all on the occasional hiccup in the game. This is why people use game controllers or a keyboard and mouse. At least I confirmed you can play an Android game on Chrome.

Next up was ArtCanvas, a drawing app. Although it said it was designed for phones, it looked normal on my Chromebook. I love to draw and was eager to see what the Chromebook Pro's stylus could do. Samsung said it had designed the stylus experience to feel somewhat like pen on paper instead of point on glass. It still felt pretty slippery, but more notably, its pressure sensitivity seemed limited. Pressing



UnderArmour's MyFitnessPal app overextends itself when viewed on a Chromebook.

The Asphalt 8 Android game requires over 1GB of storage space, which could tax some Chromebooks' skimpy storage.

harder gave a thicker line, while a lighter touch would give me a thinner one. If I wanted a darker color, I'd have to add layers by going over an area repeatedly. I also tried my finger, which gave me a finger-width line in most cases—and as with the stylus, minimal pressure response. With everything still in beta, I'm not making any declarations here, merely suggesting the stylus might need further refinement.

Note-taking's the thing

The stylus excelled at taking notes, though. As much as I treasure real keyboards, sometimes it's just easier to write than to type, especially if you're squished into a commuter train or trying to be unobtrusive at a meeting. I used Google Keep to write and store notes—not surprisingly, the beta Chrome OS made this very easy to do. The stylus worked well as a simple pen, and Google Keep did a decent job of interpreting my scrawl and turn it into type.

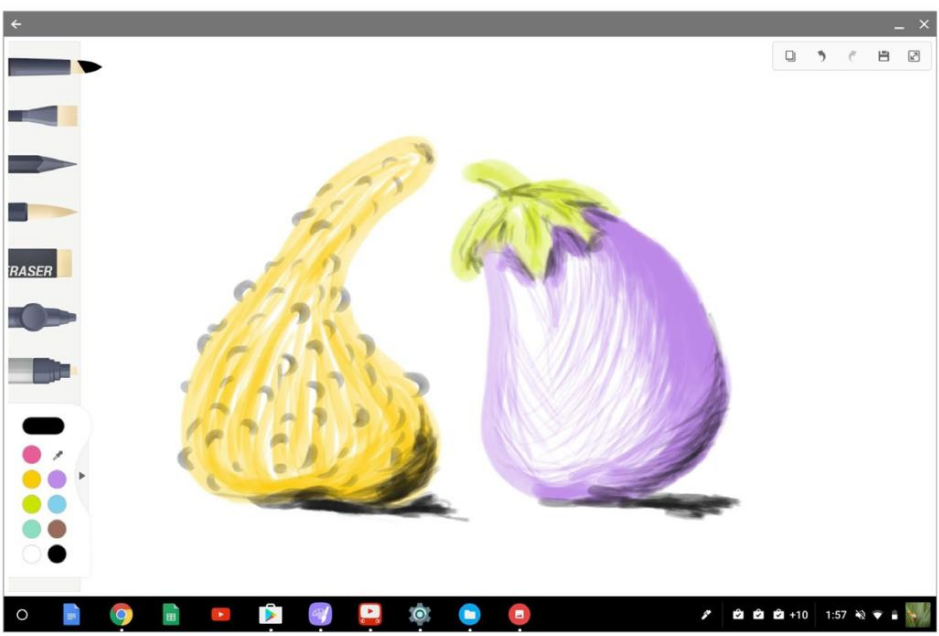
The key takeaway: The Chromebook Pro (and its lower-end cousin, the Chromebook Plus) show how Chrome can evolve by following the pen-enabled Windows toward more intuitive input methods. That leaves just

one platform—MacOS—stubbornly resisting putting pen to PC.

There was a time when merging Android and Chrome seemed crazy. Yet here we are now, poised to throw open the borders and let Android apps pass freely.

After my brief encounter, I can say Android apps on Chrome feel reasonably comfortable (if sometimes odd), and they're probably safer—at least for now. Android apps may open a lot of opportunities for Chromebooks, but they could also attract bad actors to this fairly pristine platform. We might yearn for the good old days, when only novices and schoolkids cared about Chromebooks.

We can look forward to a slew of new Android-friendly hardware in the coming months. Apparently Google will also try to bring along as many older Chromebooks as it can, though all bets are off (go.pcworld.com/chrmbk5yr) for those five years and older. I'm definitely holding onto Instagram and look forward to seeing how it and other Android apps migrate to Chrome.



The ArtCanvas Android app lets you try the new stylus capabilities on the Samsung Chromebook Pro.

Quern - Undying Thoughts: The closest we may ever come to a *Riven* sequel

BY HAYDEN DINGMAN

2016 WAS ONE hell of a year for *Myst*-alikes, eh? Straight from the source, from Cyan itself, you had official spiritual successor *Obduction* (go.pcworld.com/obduction)—a game which crept onto our Games of the Year list (go.pcworld.com/10bestgames). Then there was The *Eyes of Ara* (go.pcworld.com/10pcgames), which utilized the same sort of puzzles although in quite a different sort of setting.

But I wish I'd gotten around to playing *Quern - Undying Thoughts*. I don't know why I didn't, although it certainly wasn't helped by a late November release nor its impenetrable title.

I recently delved into *Quern*'s world though—nothing like those slow Januarys for catching up on your backlog—and it's excellent. Like *Myst* of old, you arrive in an area with no idea how you got there or what you

should be doing. In this case you've been teleported to an island by way of a massive gateway which promptly self-destructs upon your arrival.

There's a way off the island though, approximately 50 locked doors and dozens of puzzles in your future. Puzzles involving gears and simple mechanical contraptions, puzzles involving audio cues, puzzles involving some lightweight botany, and puzzles involving a whole series of crystals each of which has its own unique properties.

Along the way you'll delve into the origins of the titular island, *Quern*. The island's previous occupant has left behind directives, notes on the peculiar properties Quern possesses, the secrets he's uncovered and what he's done with said knowledge. His journal entries lead you from area to area, sometimes giving context, sometimes giving clues, and all apparently part of some plan. But what plan? And why?

Quern - Undying Thoughts

AT A GLANCE

Quern – Undying Thoughts is an excellent first-person puzzler that's likely to be doubly special to anyone who spent hours with *Myst* or *Riven* in the past.

PROS

- The closest a game's ever come to duplicating *Riven*'s aesthetic
- Mostly-excellent and logical puzzles, barring a few missteps

CONS

- Too much backtracking at certain points
- In-game notebook feature isn't as useful as it first appears

$25

★★★★★

It's as close to a *Myst* game as I've ever seen from another developer. Or rather, a *Riven* game.

Riven's Jungle Island.

This is the first village you enter. It's your main hub and where you'll spend a good portion of Quern. And it's incredibly reminiscent of the bleached-white adobe buildings that dotted *Riven*'s Jungle Island.

Those huts may represent the most obvious parallel, but the game reeks of Cyan's mid-'90s output. It has the same sense of weary isolation, the same unexpected warmth to its grimy copper gizmos, and that feeling of "Normal" and "Alien" bashed together in one place. Here, a library. There, a forge. Everyday objects, but all of it residing in a world so unique and unusual.

Between the focus on mechanical puzzles and the aesthetic nod, *Quern* feels like the *Riven* successor we never really got (and likely never will get). It's grim and lonesome in the same way that made *Riven* a classic—and much closer in tone to *Riven* than Cyan's actual sequel, *Myst III*.

And it takes the same approach to puzzles—not just in terms of aesthetics, but philosophically. *Quern* loves introducing new ideas and puzzle constraints at a rapid pace and then disposing of them at will, adhering to a certain internal logic but unconcerned with building on its own foundation.

Hell, there's even a puzzle similar to *Riven*'s famous spinning room.

Quern's not nearly as bash-your-head-against-a-wall obtuse, of course. While *Riven* occasionally stumps me even today, twenty or so

years after I first played it, *Quern* is breezier. Benefiting from an additional two decades of puzzle design and fully 3D environments, it took me maybe eight or nine hours to get through. Not too bad.

It's also not a perfect game. Some of its puzzles fall into the typical adventure game trap—very obvious solution buried under a cumbersome series of steps. One puzzle is just a retread of the *Knights of the Old Republic* puzzle where you do a bunch of column math to blow up injector pods on Manaan. (Yes, it's as boring as it sounds.) And you do it *three* times here. Ugh. There are a few other stinkers, but that one's the worst.

The game also includes a seemingly handy Notebook feature, which is supposed to function like in-game screenshots. You see something important, a clue to a puzzle, and you can "jot it down in your notebook" at the touch of a button. *Quern* then makes a cool little sketch-representation of whatever item you were looking at.

Problem being the sketches are often not legible or high-resolution enough to be useful, only display four to a "page," and each time

you access them you're treated to a two-second animation that *kills* the pacing.

I ended up grabbing a normal notepad and paper like it was 1994 again. But even that impulse, grabbing a notepad and jotting down clues, feels reminiscent of the games that inspired *Quern*. It makes me feel proper nostalgic, and I can't knock it too hard on that account.

Bottom line

Quern – Undying Thoughts is an excellent first-person puzzle game that's likely to be doubly special to anyone who spent hours with *Riven* in years past. Reminiscent of both that style of storytelling and of puzzle design, it's an excellent homage in an era suddenly packed full of *Myst* homages.

A few subpar puzzles and some ill-paced backtracking sometimes get in the way of *Quern*'s ambitions, but my standard adventure game advice applies: Just check a walkthrough if you really feel the need to. It's worth seeing through to the end.

D-Link DCS-8200LH HD 180-Degree Wi-Fi Camera: An all-seeing eye for large spaces

BY MICHAEL ANSALDO

MOST HOME SECURITY cameras are adequate to monitor a single room, but that doesn't mean they see the whole room. In all but the smallest spaces, there will be blind spots. Cameras with sound detection mitigate this by alerting you to action happening off camera, while those with mechanical pan-and-tilt let you look at different areas of the room by changing the camera's viewing positing on the fly.

D-Link's HD 180-Degree Wi-Fi Camera (model DCS-8200LH; go.pcworld.com/dcs8200lh) takes a different approach: It uses an ultra-wide-angle lens to take in all the scenery at once so you never have to wonder if you're missing something. It can also be used together with other mydlink connected home products. For example, if your D-Link Wi-Fi Water Sensor detects a leak, you can take a peak at what's going on through the camera's feed.

The DCS-8200LH's ultra-wide-angle lens allows it to take in even large rooms without changing position.

If you're used to the spheroid motif of most Dropcam-style security cameras, you may be taken aback by the DCS-8200LH's design. Instead of being housed in a tennis-ball style enclosure, the camera and its pair of infrared LEDs are mounted to a smartphone-size rectangular body. The whole unit screws into a stand for tabletop placement, or alternatively can be affixed to a wall or ceiling with the provided screws.

The DCS-8200LH's unique design is presumably to give its 180-degree lens an unobstructed field of view. Indeed, it allows you to take in a wide swath of your home or business landscape without having to change the camera's position or use multiple cameras. De-warping technology is also built in to counter the fisheye distortion that's a troublesome byproduct of wide-angle lenses.

The camera supports both sound and motion detection with responsive recording—any noise or movement will trigger a video to be recorded in up to 720p resolution and you'll get a push notification alert. You can also use IFTTT to pair the camera with other manufacturers' smart devices to trigger additional actions when an event is detected. For example, you can have your Philips Hue lights automatically turn on when a loud noise is detected, or have the camera start recording video when your Ring doorbell is rung.

Like other D-Link home security cameras, the DCS-8200LH does not support cloud recording. All video footage is recorded locally to MicroSD/SDXC (up to 128GB, card not included). This saves you the cost of a monthly or annual cloud subscription, but also leaves your surveillance footage vulnerable should an intruder take the camera or destroy the memory card.

Setup and usage

The DCS-8200LH requires a bit of assembly—mainly mounting the camera body to its stand—before you can use it. Once that's done, you need

D-Link DCS-8200LH HD 180-Degree Wi-Fi Camera

AT A GLANCE

The D-Link DCS-8200LH HD Pan & Tilt Wi-Fi Camera is a fantastic option for monitoring large spaces or tracking active kids and pets.

$118

★★★★★

to download the mydlink Home app, which will guide you through the process of connecting the camera to your Wi-Fi Network.

The app itself is well designed and it's easy to find your way around. Beneath the image of the live camera feed are buttons for (from left to right) turning the audio on and off, snapping a screenshot of your feed, toggling between 360p and 720p resolution, accessing video clips, and setting the camera's night vision (off, on, or auto). The app works in portrait and landscape mode, though the latter is recommended to maximize that wide-angle view.

Image quality is excellent in both day and night modes, with crisp details even when using the 8x digital zoom. The de-warping works well, too; only objects at the nearest periphery of the lens showed any image bending and it was very slight. Audio was also great, with no distortion or extraneous noise, though it's a bit of a disappointment that it's only one-way. Most cameras include a built-in mic for two-way communication—you can talk to kids or pets at home or scare off intruders—so this is a puzzling omission.

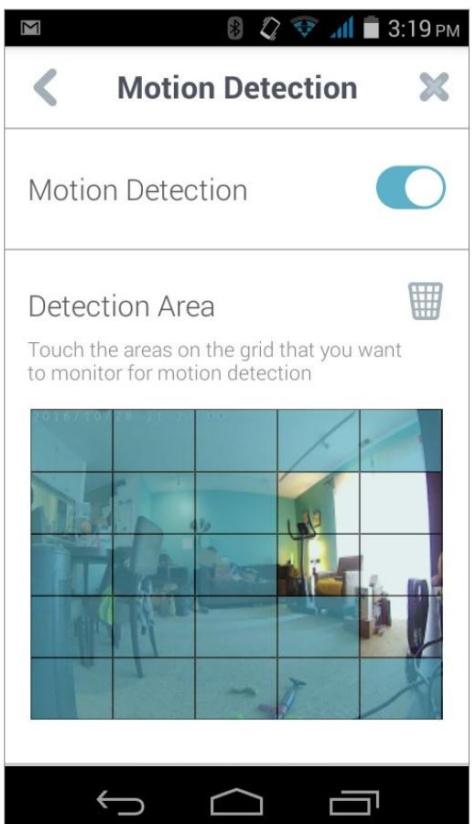
The DCS-8200LH doesn't follow the typical Dropcam-style design cues.

Motion detection always carries the risk that you'll be inundated with alerts when the camera mistakes incidental movement, such as a fluttering curtain or an errant pet, for a security breach. That's especially significant with a camera that covers as much ground as this one does.

Fortunately, the mydlink Home app offers several ways to customize motion detection to reduce false alarms. First, you can set motion

detection areas—you just tap squares on a grid over the area you want to monitor. This is helpful if you just want keep an eye on a door or window, or exclude the area where your dog is restricted when you're away. You can also adjust the motion sensors sensitivity with a slider that ranges from "low" to "high," though this takes some experimentation to calibrate. Lastly, you can turn off motion detection completely when you're home if you don't want to unplug the camera.

Though sound doesn't typically pose the same false alarm issues unless your home has a lot of ambient noise, you can adjust the sound detection settings as well. For this you have to turn the Noise Level feature on, then you can set a threshold of 70 dB to 90 dB.



Bottom Line

Other than its 180-degree lens, there's really nothing remarkable about the DCS-8200LH. But that's not necessarily a bad thing. All the standard security features are here, and if you're looking for a camera that "just works," this one fits the bill. Its generous field of view allows you to place it without having to fuss with various angles, and the mydlink Home app can be mastered in mere minutes. The IFTTT support is attractive if you're already using a lot of other smart home appliances. The lack of cloud backup is always a concern in our view—how else to ensure the security of your security footage?—but if you can live without it, the DCS-8200LH is a simple solution you can rely on.

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7 WAYS TO SAVE MONEY WHEN YOU BUILD A PC

Building a PC doesn't have to break the bank.

BY BRAD CHACOS

For many enthusiasts, part of the fun of building a PC lies in not spending a penny more than necessary. Whether you're building a basic everyday computer (go.pcworld.com/diybudgetpc300) or trying to eke out a $500 gaming rig (go.pcworld.com/diygamingpc500), shopping smart lets you do more with your money or, well, just plain save some cash on a purchase that's already pricey enough.

Good news: Costs savings abound, especially if you're not in a rush. You just have to know where—and how—to look. These tips and tricks will help you save money on your next PC build.

PLAN IT OUT!

Measure twice, cut once. That timeless advice applies to PC building too. Think through every aspect of your build before picking up even a single component to ensure that you're not buying too much, or too little, power for your needs—and that everything you buy works together. Planning is the most

important part of building a PC.

Regularly updated component guides such as *PCWorld*'s own best graphics card roundup (go.pcworld.com/pcgc), Tom's Hardware's computer processor overview (go.pcworld.com/tomsbestcpus), and the Wirecutter's SSD recommendations (go.pcworld.com/wcbestssds) can help you identify the best parts for your particular workload, no matter what your budget is. Once you've identified the processor you need, you can choose a compatible motherboard with the connectivity features you need, and once you've identified a motherboard, you can choose what type of memory and storage to slot into it, and so forth.

If you want more in-depth guidance on your build, head over to either PCPartPicker's Build Guides section or the Build a PC subreddit (reddit.com/r/buildapc). PCPartPicker's loaded with tried-and-true builds of other users, with all sorts of filtering options, user rankings, and discussions to help you home in on a computer configuration that's right for you. Meanwhile, Build a PC's a tremendously active and helpful forum where thousands of PC enthusiasts can help answer any questions you have or help you plan out a PC build step-by-step. (Be sure to check out the Resources section pinned to the right rail of the subreddit for helpful guides!)

Reuse those case fans if you can!

REUSE WHAT YOU ALREADY HAVE

If you already have a computer, you can save a lot of money by reusing its parts inside your new PC.

Building a new PC usually revolves around a new processor and motherboard, but there's a decent chance you'll be able to drag your older graphics card, storage, memory, or case over, especially if you're replacing a PC that you purchased in the last decade or so. My personal rig packs some hard drives and case fans that have survived several builds at this point.

Of course, be sure your old components are compatible with your new ones first. Older hard drives might rely on an interface that isn't supported anymore, while many modern motherboards only support newer DDR4 memory—which means you can't just slap in your existing DDR3 RAM. The free Belarc Advisor tool (belarc.com/free_download) can scan your current system and let you know fine details about every component inside. Bonus: Belarc also reveals your software product keys to make migration to a new PC easy-peasy.

Okay, so you know exactly what parts are going into your new PC. Exciting! Now it's time to head to the aforementioned PCPartPicker (pcpartpicker.com), an absolutely invaluable resource for computer

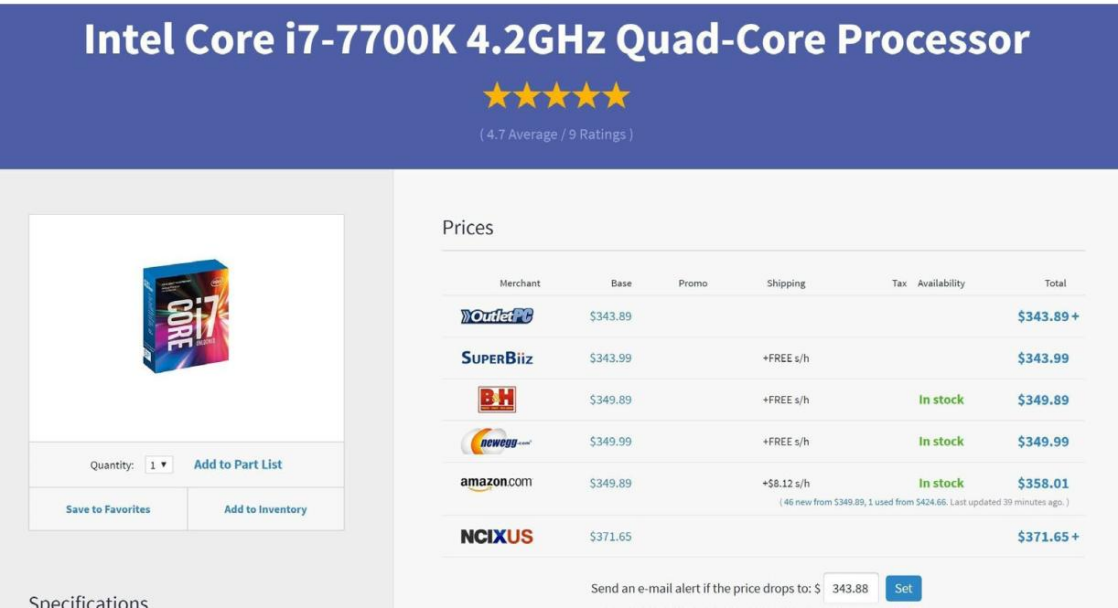
enthusiasts.

PCPartPicker lets you virtually assemble (pcpartpicker.com/list) your build piece-by-piece, down to every last component. If there are any system incompatibilities—such as the wrong motherboard, memory, or CPU cooler—the site will warn you about it. Extremely handy stuff.

But it's the money-saving aspects of PCPartPicker that earn it a spot in this guide. The site scours all the major electronics retailers in your corner of the web, so for each component in your build, you can drill down and see the best available price, along with shipping costs, applicable promo codes, and availability. (See the picture of the Core i7-7700K listing.) What's more, if you aren't satisfied with the prices you see for a given piece of hardware, you can ask PCPartPicker to send you an email notification if the cost dips below a price of your choosing.

How do you know if a PC component is priced competitively? PCPartPicker also offers tools that reveal recent price drops (pcpartpicker.com/products/pricedrop) and show historical pricing trends (pcpartpicker.com/trends) for all sorts of hardware.

Seriously, use PCPartPicker. It saves you real money, real fast.

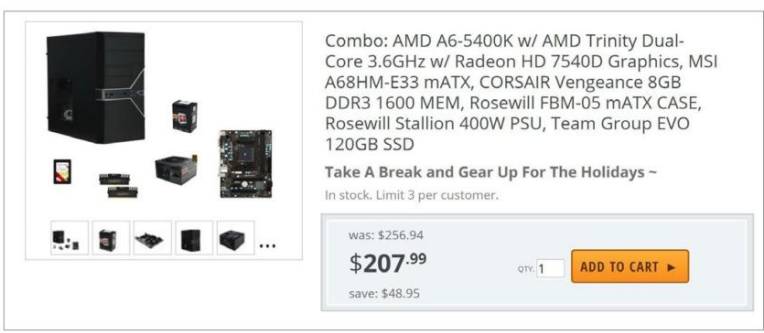


PCPartPicker's listing for Intel's high-end Core i7-7700K processor.

BUT SHOP AROUND

All that said, you might be able to save even more if you shop around before you pull the trigger on any given PC component. Micro Center is famous for offering steep in-store deals for processors, so swing by if there's one in your area. Other retailers, such as Fry's, may offer open-box or refurbished models of hardware available at deep discounts. (Just be sure to know the warranty details for those parts—you want to get your money back if the hardware fails.)

Even if you don't have a physical retailer nearby, spend some time digging around Newegg for some of the key parts of your build. Newegg constantly offers bundles that group together several compatible components at a discounted total price. You can see them all (go.pcworld.com/diypccombo), or navigate to the page of one of the individual components on your list, where any available bundle offers should be on display.



Many Newegg bundles are ho-hum, but there are definitely gems to be found, like the $48.95 savings on this AMD A6-5400K bundle (go.pcworld.com/amda6).

TAKE YOUR TIME!

Did you notice the subtle subtext running through the last few tips? It's this: If you don't need a new PC *right now*, there's no rush to buy your PC's parts after you've planned out your build. Waiting gives your target hardware an opportunity to drop in price, and gives you more time to hunt around for better deals at various storefronts. Patience is a virtue.

Just don't wait so long that the warranty expires on the parts you're slowly stockpiling. If a component's dead on arrival, you want to know before the window to return it closes.

CONSIDER USED PARTS

Unless you're lucky enough to be shopping right when a fresh generation of gear hits the streets and retailers are trying to clear stock, buying last-gen PC hardware won't save you much money. If you really need to save some scratch, you could potentially save big money buying used parts. You have to be careful, though, since used hardware doesn't come with warranties and there's always the chance a part was ridden hard before it wound up in your hands.

As a general rule of thumb, processors, memory, and cases can usually be bought used without much concern, since they don't have moving parts. (Ask if the processor was overclocked at a high voltage before buying, though, and avoid it if so.) Graphics cards are iffier but they can be okay if you can confirm that it's working, is not caked with dust, and hasn't been running at a high overclock for an extended time.

Opinions vary about used motherboards, but since they're the core of your PC and have lots of parts that can fail, I avoid them. Also avoid buying used storage drives, as they have finite lifespans and in the case of hard drives, moving parts. I'm also leery of picking up a used power supply, as it's both an important backbone of your system and has moving parts. "Air" CPU coolers with heat sinks and fans typically should be fine, but avoid used closed-loop liquid coolers as those wear out eventually.

It's best if you can see used PC hardware working before you buy it,

The r/ hardwareswap subreddit relies on "timestamp" images that show the used PC hardware in your possession, and in working order.

which means that local sales and Craigslist are ideal. If you need to buy used PC parts online, the r/hardwareswap subreddit (reddit.com/r/hardwareswap) is a hotbed of activity. You can sometimes find good deals on Amazon (go.pcworld.com/usedpcpartsamz) and eBay, too, and those sites offer consumer protections that can often get you a refund if you're sent a dud. Just do the math to make sure those shipping charges aren't eating too deeply into the savings. And always, always check an online seller's reputation before you shell out hundreds of dollars for a used part.

SAVE ON SOFTWARE TOO

Hardware isn't the only cost when you're building a new PC. Software can add up quickly—but it doesn't have to.

For a lot of people, the biggest software cost is Windows, at $100 or more. There are compelling reasons (go.pcworld.com/trylinux) to try a no-cost Linux OS, but if you want to stick with Windows, you can often find people selling Windows licenses for under $30 on Kinguin (go.pcworld.com/kinguinw10), which is like an eBay for software.

As for all the other must-have software that makes a PC actually useful, check out *PCWorld*'s guide to the 15 free programs your new PC needs (go.pcworld.com/22free).

BRING IT ALL TOGETHER

And that's it! Hopefully these tips help you save some cash as you're building a PC. If you need help actually putting all those parts together, we've got you covered. Check out *PCWorld*'s comprehensive guide to building a PC (go.pcworld.com/diypc), a series of articles that covers every aspect of the process, from installing processors and case fans to avoiding common PC building mistakes (go.pcworld.com/pcbuilderrors). If this is your virgin foray into the wonderful world of PC building, be sure to read 7 things I learned once I built my first PC (go.pcworld.com/7thingsdiypc).

And finally, once more before this ends: Use PCPartPicker (pcpartpicker.com). It really is great.

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VIRTUAL REALITY, ONE YEAR OUT: What went right, what didn't

BY BRAD CHACOS

ILLUSTRATION BY ALDO CRUSHER

Players enjoy a VR experience at HTC's Vive-land arcade in Taiwan.

AFTER YEARS OF TEASES, tantalizing promises, and Kickstarter campaigns, virtual reality finally became actual reality in 2016, with VR's mere existence thrusting the entire PC industry into glorious, wonderful turmoil. Despite being around for just a handful of months, virtual reality has already inspired totally new genres of computers, wormed its way deep into Windows, and sent the price of graphics cards plummeting.

Not too shabby for VR's first real year on the streets, though the implementations could still use some fine-tuning. Let's look back at how this wild new frontier blossomed in 2016.

The birth of consumer virtual reality

From the very start of 2016 it was clear that the dawn of proper PC-powered VR had arrived. You could see evidence of this fact all over CES 2016 (go.pcworld.com/ces16vr) in January, where EVGA introduced a specialized graphics card designed to fit VR headset ergonomics; Nvidia rolled out a VR certification program (go.pcworld.com/vrcert); and seemingly every booth boasted some sort of virtual-reality hook, from VR treadmills (go.pcworld.com/vrtred)

to VR porn (go.pcworld.com/vrporn) and VR Everest climbs (go.pcworld.com/vreverest) (the latter two being mind-blowing in their own ways).

The PC world was ready. But virtual reality itself wasn't, at least until the Oculus Rift's big consumer launch later that spring.

Well, big in theory. While *PCWorld* praised the Oculus Rift (go.pcworld.com/riftrev) in its review—virtual reality was here, and it was magical!—the launch was far from perfect. The rumbling began in the run-up to the headset's release, with Rift's $600 launch price far exceeding the $250 to $500 range that Oculus higher-ups had teased repeatedly. Once it actually launched, the headset was plagued by hardware shortages and significant shipment delays, which didn't go over well at all.

But the biggest problem for the Rift was that even at launch its days already felt numbered—not a vibe you want from $600 hardware. The Rift was designed primarily as a seated VR experience, with a controller in your hands. By the time it launched on March 28, enthusiasts and industry press had already spent time playing with the SteamVR-

The Oculus Rift

The HTC Vive

powered HTC Vive, which used made-for-VR controllers and dedicated tracking stations to enable room-scale VR experiences that let you wander around and actually touch things. After trying Vive, going back to the Rift's sedentary experience felt far less satisfying.

And the HTC-Valve duo didn't waste any time capitalizing on its advantage. The HTC Vive (go.pcworld.com/viverev) launched on April 5, roughly a week after the Oculus Rift, and immediately seized the crown as *PCWorld*'s preferred VR solution.

Despite that, we recommend passing on the Rift and the Vive, and for very good reason. While VR can be nothing short of awe-inspiring, these first-gen products also have some obvious flaws.

Prices and PCs

Man, virtual-reality headsets are expensive.

That's to be expected with bleeding-edge hardware, but $600 for the Oculus Rift or $800 for the HTC Vive puts them firmly in the "one percent" category. The recent release of Oculus's $200 Touch controllers (go.pcworld.com/oculusrev) drove the cost of a full Rift setup to the Vive's level, or even more if you want kinda-sorta room-scale experiences and need an extra sensor. VR experiences tend to be high-priced and relatively short-lived compared to traditional PC games. This is not a cheap hobby.

That priciness was exacerbated by the need to connect these headsets to a pretty powerful PC—that cost of which was roughly $1,000 to $1,500 at the time of the headsets' launch. Fortunately, while the Vive and Rift themselves have stayed at the same lofty prices, the cost of a computer to run them absolutely plunged as the year carried on.

The plunge began with the launch of AMD's Radeon RX 480 (go.pcworld.com/rx480rev), which revolutionized what's possible with a $200 graphics card. Before its release, VR-capable graphics cards cost nearly twice that amount. (Nvidia quickly followed suit with the $250 GeForce GTX 1060.) Jumping forward two full technological generations paid major dividends for graphics cards.

Software tricks helped democratize VR just as much. At the Oculus Connect conference in October, the company revealed a new feature dubbed Asynchronous Spacewarp that used technical tricks to drive the barrier to entry for Rift VR way, way down—all the way to an AMD AM4 or Intel Core i3-6100 processor, and a GeForce GTX 960 graphics card. In March, a Rift-ready PC cost at least $1,000; after Oculus

Oculus Rift with its Touch controllers.

The AMD Radeon RX 480.

Connect, Rift-ready PCs started at $500 (go.pcworld.com/riftpc), and there was even a Best Buy promotion (go.pcworld.com/riftdeal) offering a full PC and the Rift itself for $999.

Hot damn, prices plunged fast. And another pesky PC VR problem is already in everybody's sights.

Wired woes

The HTC Vive and Oculus Rift both drive very high-fidelity gaming experiences, and headsets need to be physically tethered to your PC in order to work. That kind of sucks. It's all too easy to trip over the thick cables while you're wandering around the room ensconced in a virtual world, or to twist and turn so much that the cord eventually jerks your head back.

That (sometimes literal) headache inspired the birth of a whole new class of gaming PCs—ones that you wear on your back. You're still wired up, sure, but those wires travel with you instead of getting tangled between your feet. Zotac, MSI, Alienware, and HP have all revealed backpack PCs of various designs, though none have actually hit the street yet.

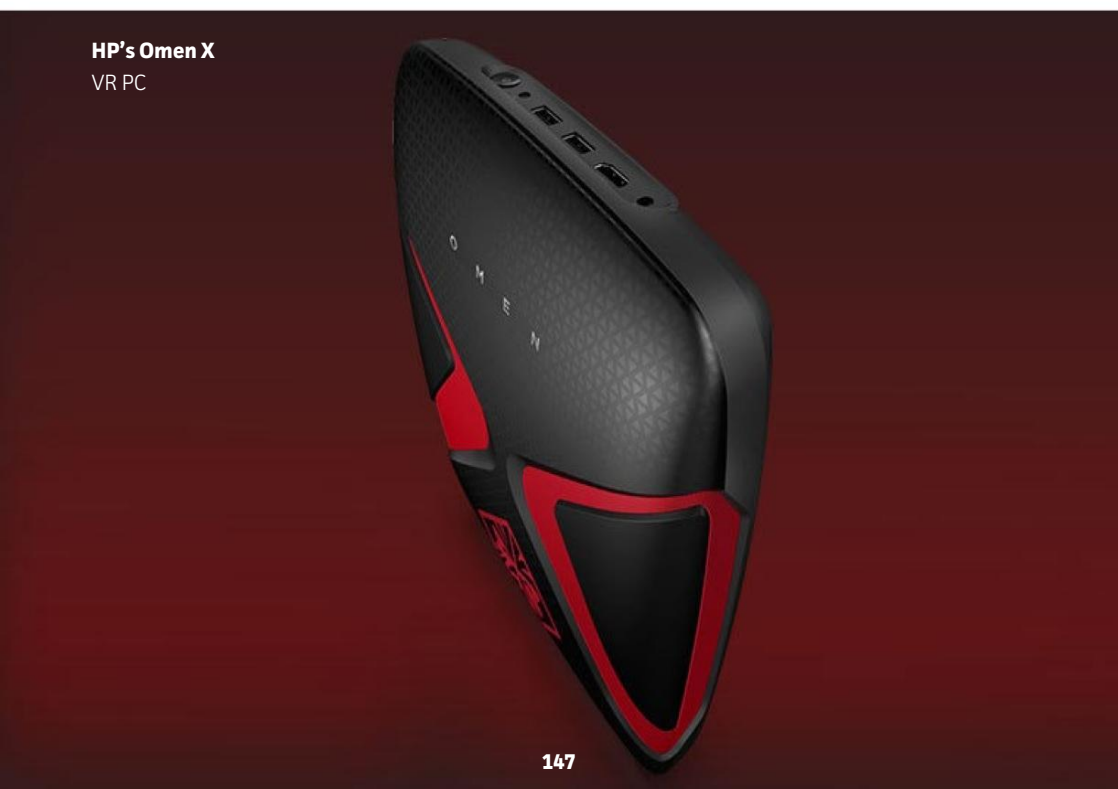
As nifty as they are, however, backpack PCs feel like a stopgap

solution—a fix to a problem that will disappear when more robust wireless display technologies or more potent mobile graphics arrive. And you can already see that wireless future on the horizon, with Oculus testing a fully self-contained mobile Rift prototype (go.pcworld.com/riftproto) and HTC backing a $220 add-on kit (go.pcworld.com/vivewire) that makes the Vive wireless.

Beyond PCs

While powerful PC-based VR experiences may be tethered, the more modest world of phone-driven mobile VR has already left cords far behind.

Samsung's Gear VR headset (which only works with Samsung Galaxy phones) blazed the Android VR trail, while Google's low-cost Cardboard (go.pcworld.com/gcardb) brought it to the masses. In late 2016 Google stomped into the Gear VR's turf with Daydream VR, an



HP's Omen X
VR PC

Android-centric initiative (go.pcworld.com/ddvr) that brings premium mobile VR to the entire ecosystem rather than Samsung's phones alone.

Daydream centers on a trio of pillars: powerful phones, Daydream VR headsets, and Android Nougat's new VR features. While Google's own Daydream View (go.pcworld.com/ddrev)headset and Pixel phone (go.pcworld.com/pixelrev) kicked off the program, Daydream isn't its alone. HTC, LG, Xiaomi, Huawei, ZTE, Asus, Alcatel, Lenovo, and yes, even Samsung have pledged to create Daydream mobile devices.

The stand-alone Oculus "Santa Cruz" prototype.

Microsoft's HoloLens (go.pcworld.com/holohn) is kind of a mix of PC and mobile VR, while also a different beast entirely. It's a portable, fully self-contained system that doesn't need to connect to a PC, but HoloLens utilizes augmented reality, not virtual reality. Virtual reality plops you in fully realized virtual worlds; augmented reality, as the name implies, augments the real world with overlaid objects, such as a *Minecraft* world sprouting from your coffee table or a Skype video chat appearing on your wall.

Microsoft still hasn't revealed details about when (or if) HoloLens will be available to consumer users, or how much it would cost, but deep-pocketed developers and enterprise users can already pick up the headset for a cool $3,000.

The future

The pricey HoloLens headset isn't Microsoft's only foray into VR. The forthcoming massive Windows 10 Creators Update (go.pcworld.com/w10up3) will bake *augmented* reality features much, much more deeply into the flagship PC operating system, and it'll be accompanied by an

army of new Windows 10 VR headsets (go.pcworld.com/w10vr) at launch—headsets that will start at just $300 and run on surprisingly modest PCs (go.pcworld.com/wintel). Meanwhile, Intel and Microsoft's Project Evo partnership aims to change how computers "think, see, and hear," with a specific goal of driving mixed reality forward.

> If 2016 was the birth of a virtual-reality revolution, look for 2017 to be a year of VR refinement.

If 2016 was the birth of a virtual-reality revolution, look for 2017 to be a year of VR refinement. Witness the new, Oculus Touch-esque Vive controllers (go.pcworld.com/vivecntrlr) that Valve already began to tease, and bookmark the holiday 2017 launch of Microsoft's powerful Xbox Scorpio (go.pcworld.com/prjscorpio) console—which could very

Google's Daydream View

A Microsoft rendering shows simulated HoloLens apps.

possibly leverage the Windows 10 Creators Update to run the Oculus Rift or Windows 10 VR headsets as a counter to Sony's surprisingly okay PlayStation VR.

Next year, VR games should only get better as developers gain more experience…if they can navigate the complicated world of consumer expectations (go.pcworld.com/vrdevel) and discover what people really want from the medium, that is. The cost of VR-capable PCs will only keep going down. Expect augmented reality to continue making inroads in car tech. The Vive and Rift may even get price cuts! Heck, with enough advances, 2017 may be the year *PCWorld* officially recommends you buy a VR headset.

Or it could all come crashing down like previous virtual-reality attempts. (Remember Sega VR go.pcworld.com/segavr?) Living on the bleeding edge may be expensive and exciting, but it's not always a sure bet—though with so many of tech's biggest names spending billions on virtual reality, it's hard to imagine this latest push fizzling completely. Time will tell.

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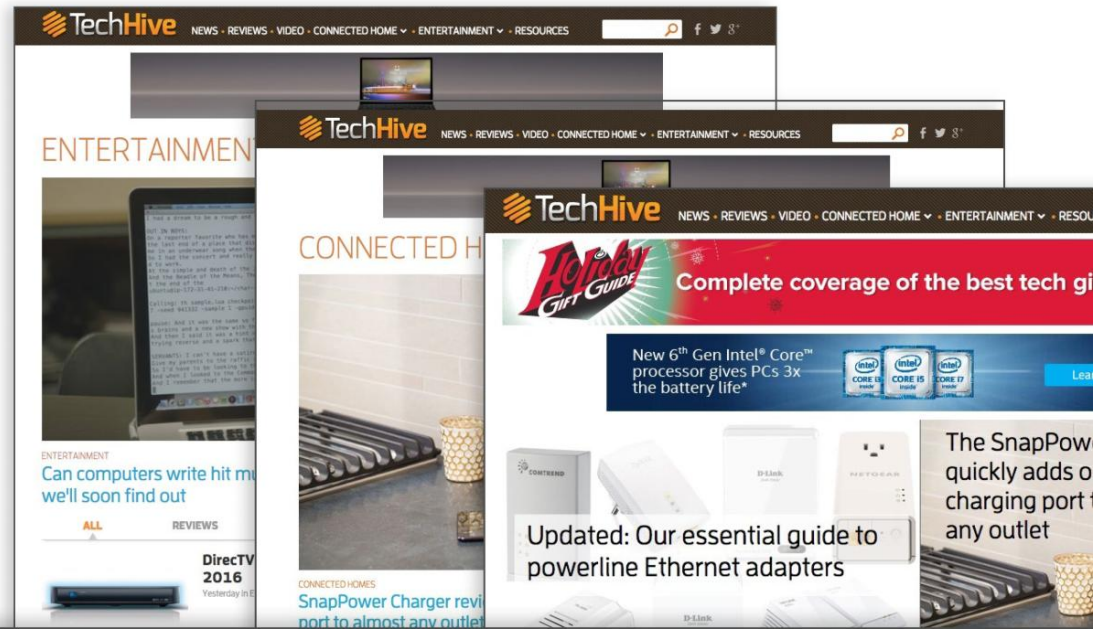

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If we show you how to back up your PC for free, will you finally do it?

BY MARCO CHIAPPETTA AND LINCOLN SPECTOR

IF WE SHOW you how to back up your PC for free, will you finally do it? Beyond simple hard-drive failure, your PC could fall prey to user error, thieves, and all sorts of nefarious malware. The only way to ensure that none of your personal files or programs are lost in a catastrophe is to back up everything regularly.

While backing up your data can be as simple as dumping critical files on an external hard drive every now and again, you'll ideally want backups that

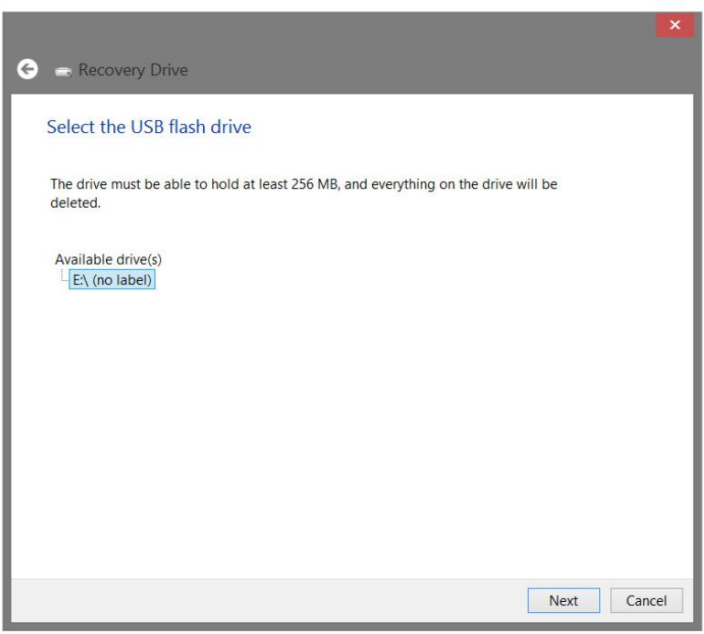
let you recover not just yesterday's version of a lost file, but last Tuesday's as well. Backups should be easy to do, or they won't get done. And ideally, you should have more than one backup in more than one location.

If you're thinking, "Hey, that doesn't sound free," you're partly right. All of the software we're recommending here is either free or comes with Windows. But you must buy storage, either in external hard drives or the cloud. (Why an external hard drive instead of a flash drive? Because in this case, capacity is far more important than speed.)

Creating Windows images with System Backup

Windows' built-in imaging tool creates a backup of everything on your drive, including Windows itself and your settings, programs, and data. Image backup is the best way to protect your Windows installation. Windows' built-in tool is nowhere near as comprehensive as some premium solutions, but for maintaining a personal computer, it's acceptable.

Your image backup could prove unusable if you don't prepare a recovery drive as well. This is a flash drive that can boot into Windows' recovery tool even if Windows itself can't boot. Plug a flash drive (at least 8GB, go.pcworld.com/w10recov) into your PC and make sure it's working. Type **recovery** in Windows 7's Start menu, Windows 8's Start screen, or Windows 10's



You need to use a recovery drive to restore the images created with the built-in Windows imaging tool. Creating one takes only a few minutes.

search field, then click the Recovery link in the results. In the window that opens, click the link to create a recovery drive and follow the instructions. Be warned: Any data on the drive will be destroyed when creating the recovery drive.

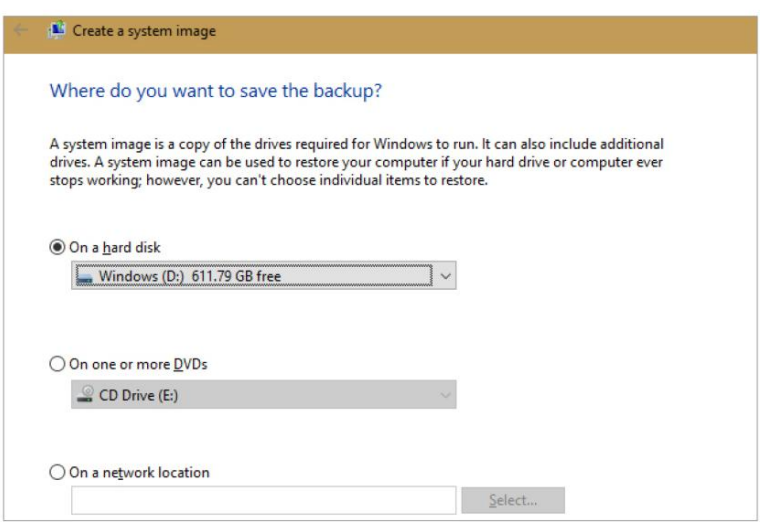
Once the recovery drive is created, try booting to it (go.pcworld.com/bootdisc). If it works properly, remove the flash drive and reboot. It's time to create your image backup.

Windows provides an easy wizard for setting up an image backup, but getting to that wizard is surprisingly difficult. And it varies with different Windows versions:

Windows 7: Open Control Panel and select *System And Maintenance > Backup And Restore > Create A System Image*.

Windows 8: Type **`file history`** into Windows 8's Start screen. Click on the *File History* link that appears and click on the System Image Backup link at the lower left of the window.

Windows 10: Right-click the *Start* button and select Control Panel. In the Control Panel Search field in the upper right corner, type **`file history`**. Click the title File History. Click System Image Backup in the lower left corner, then Create A System Image in the left pane.

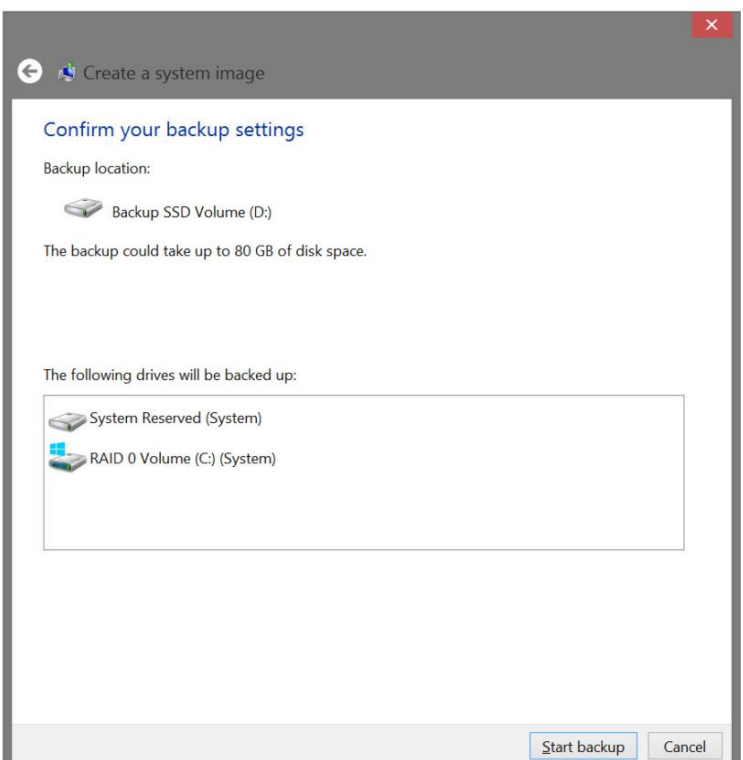


Select the destination for your system image.

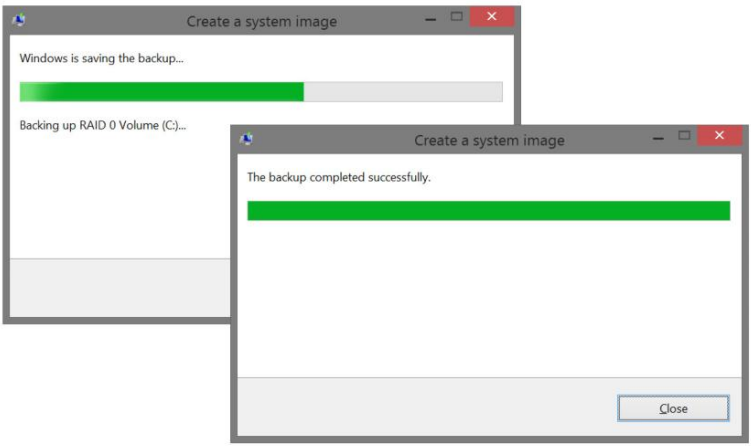
When you click System Image Backup, a Create A System Image window will open. On the first screen, you'll be asked to select the destination for your backup image. The screenshot on the previous page shows how you can select an external or secondary internal drive. You could also store the backup image on a network location or burn it to DVDs, but that last option will take *a lot* of discs and even more time.

Next, you'll be asked to confirm your backup settings. Double-check that you're backing up your primary drive, which contains your operating system, applications, personal files, and the like. If the correct drive is listed, click the Start Backup button, and the Windows imaging tool will create the system image.

Depending on the amount of data involved and the speed of the



Step Two: Confirm the source drive(s) to be imaged.



drives, this system-image creation process could take anywhere from a few minutes to a few hours.

Make a new image regularly—say, every month or two, or before you do something drastic to your PC.

The actual restoration process is also quite easy. All you need to do is boot to the recovery disk created earlier, and on the first screen presented to you, select your preferred keyboard layout. Then select Troubleshoot > Advanced Option > System Image Recovery. The tool will then automatically scan your system for images and prompt you to restore the most recent image. If you stored your image on an external drive, be sure it's connected when the recovery tool scans for images.

Backing up files locally

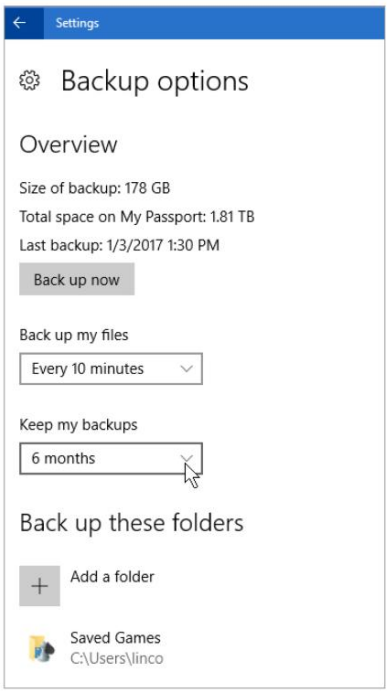
Image backups are great for restoring an entire system to its original state, but there's no need to create new images constantly when only a few files may change on a system daily.

That's where file backups come in. A file backup program copies only data files (documents, spreadsheets, photos, and so on) that have been created or changed since the last backup. You should run a file backup daily.

A good file backup program keeps multiple versions of changed

files—a feature called *versioning*. But too many old versions will fill up your backup drive, so a really good backup program will delete the really old versions to make room for the new ones. That's called *purging*.

Almost every file backup around assumes that the external backup drive is always plugged in, so it can make backups without bothering you. That's convenient, and will insure that you won't forget to back up. But if your drive is plugged in 24/7, a lot of the disasters that can make you feel glad you back up—theft, power surges, ransomware—can rob you of both your original files and the backup. It's therefore safer to plug in the drive just before backing up, and remove it as soon as the job is done.



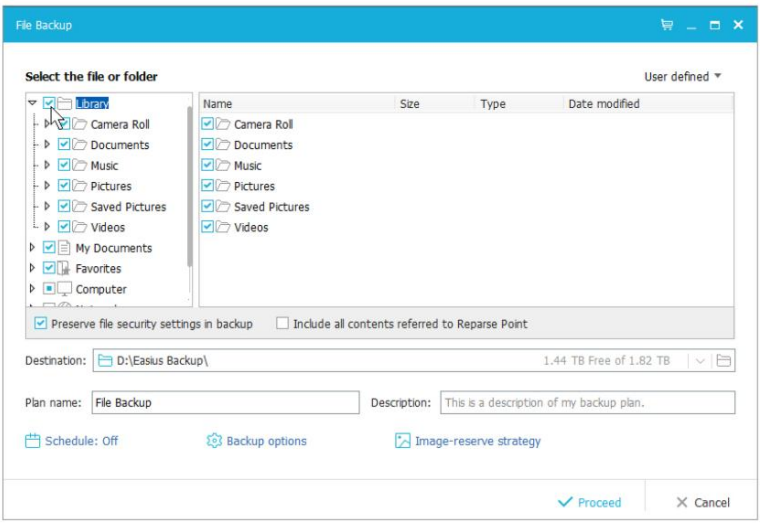
Set Windows 10's File History to back up every 10 minutes, even if you plan to plug the drive in briefly once a day. And set the Keep My Backups option for purging.

That's why I recommend you don't schedule backups. You must remember to back up manually every day.

Windows 10 has a very good file backup program called File History. To set it up, plug in your external hard drive. Then select *Start > Settings> Update & Security > Backup*. Turn on *Automatically Back Up My Files*, and click *More Options*.

Look over the settings and make your choices. Set the Back Up My Files option to Every 10 Minutes. And no, you don't have to have it plugged in 24/7.

Windows 10's backup has an excellent purging option, called Keep My Backups. But the default setting, Forever, is idiotic. Pick any other option and you'll be fine.



Easeus Todo Backup Free offers considerable more options than any backup that ever came with Windows.

Click Back Up Now to start the first, and longest, backup. After that, the backup will automatically start within ten minutes of plugging in the drive.

If you don't like Windows 10's File History, or if you use an earlier version of Windows, there are plenty of free, third-party backup programs available. They're almost all stripped-down versions of stronger programs that come with a price tag, but they have enough power for most people.

Easeus Todo Backup Free (go.pcworld.com/todoback) makes an excellent choice. It's exceptionally versatile; it can even do its own image system backups. It takes a little more time to set up than Windows 10's File History, but it can do a lot more.

When you open Todo and click the File Backup icon, you get a simple dialog box where you can create a backup profile. You can select the folders you want to back up (the obvious ones are checked by default), and tell the program where to put your backup. Links on the bottom of the dialog box—Schedule, Backup Options, and Image-Reserve Strategy—provide more options.

Image-Reserve Strategy is just a bad way of saying *purging*. And despite

the name, it works for file backups as well as images. You can purge files after *x* days or *x* backups. And you can keep the entire original backup.

Put it in the cloud!

Backing up to the cloud offers plenty of advantages. Backups happen automatically, without the disadvantages of an external hard drive that's always plugged in. And because the physical backup is nowhere near you, your whole city could burn down without destroying your data. (Although we hope that, should your city burn down, your data wouldn't be your first priority.)

If you use both a local and a cloud-based backup, you have two backups in very different locations. That gives you much better protection.

Cloud-based storage-sync-and-share services such as Dropbox, Google Drive, and OneDrive can work as backup tools in a limited way. After all, they upload your files to the cloud, and most of them do versioning and purging.

The problem is that if you're using the free versions of these tools, you can't back up much. But they can still provide an extra layer of protection for files that are particularly important or constantly changing.

If you subscribe to Microsoft Office 365, you have a full terabyte of OneDrive available to you, so you probably could back up everything. You'll have to put all of your library folders (go.pcworld.com/libr) `into your OneDrive folder. But there's another, much bigger problem with using OneDrive for backup: It only versions Office file formats. You won't be able to get back last Thursday's version of an altered photo or a KeePass database.

In addition to the sync-and-share services, you can use a cloud-based backup service—although none of these are free. Both Mozy (go.pcworld.com/mozyper) and Carbonite (carbonite.com) are excellent. Mozy costs less if you're backing up more than one PC; Carbonite's prices are better for one PC with a lot of data.

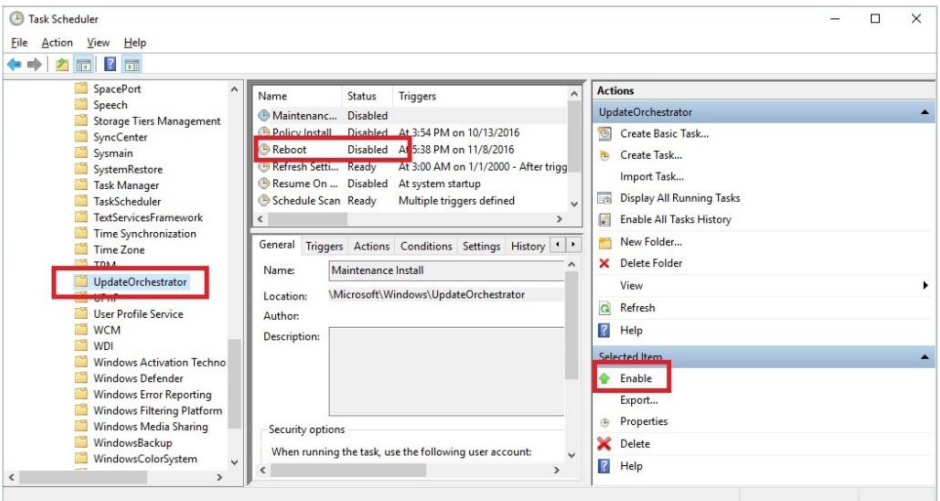
There are countless other methods and tools available to back up a PC that may be better suited to your particular needs. But this is for certain: Not backing up is like driving without a seat belt. Sooner or later, you'll be sorry.

How to stop Windows 10 from rebooting after updates

BY JOSH NOREM

TONIA JORDAN WANTS her PC to stop rebooting all by itself after Windows updates itself, and I feel her pain. I've also had the unpleasant experience in Windows 10 of leaving my PC mid-task only to come back later to find it has rebooted without any warning. And even when Windows 10 gives you a warning that it needs to reboot there's no way to postpone it anymore, so you have to save your work and let it do its thing. We get that Microsoft wants all its users to update their PCs immediately to keep their systems secure, but forcing a PC to reboot without any user input is not a good user experience.

Though Microsoft now allows you to set active hours (go.pcworld.com/updatehrs) in order to prevent an update during your regular



times of use, an update during your off hours will still be followed by an automatic reboot. That can be a problem if you're one to leave important tasks and windows open overnight. I found what appears to be the solution (go.pcworld.com/w10fix) on the Winaero blog. Note that I haven't tested it yet, as my system hasn't had a pending update as of press time, but the blog is legit and the proposed change is easily reversible.

First, right-click the Start menu and select the Control Panel.

On the upper left-hand side, at the very top, select Administrative Tools. Find and double-click Task Scheduler. In the Task Scheduler window, on the far left side, click through the following cascade of folders as follows: *Task Scheduler Library* > *Microsoft* > *Windows* > *UpdateOrchestrator*. Next, select *Reboot* in the middle pane, then click *Disable* in the far-right pane. If you get cold feet, just click *Enable* to return to rebooting.

That should theoretically prevent your PC from rebooting after an update, though if you find your PC is still rebooting it's possible a subsequent update has reversed this change, and you'll need to reset it. The original blog post also goes into next steps for stopping this problem for good.

Here you can tweak the properties of individual parts of certain tasks, such as what happens when your PC updates itself.

Gmail is dumping Windows XP and Vista, now what?

BY IAN PAUL

LIFE ISN'T GETTING any easier for holdouts on Windows XP and Vista (go.pcworld.com/xpandvista). Google recently announced that Gmail would stop supporting Chrome (go.pcworld.com/chrome53) version 53 and lower by the end of 2017. The move specifically impacts XP and Vista since Google capped support for both of those systems at Chrome v49.

So what does this all mean for XP and Vista users? Is Gmail going to stop working in Chrome? Not exactly, but it could suck a whole lot more.

The first thing is that on Wednesday, February 8, a banner should have appeared at the top of Gmail encouraging users to upgrade their version of Chrome. That's obviously not going to happen if you can't upgrade because you're limited to Chrome 49.

Then, by the end of 2017, it appears that Google could possibly redirect at least some users to the basic HTML version of Gmail

instead of the "web app" version you see now, although it's not a certainty yet.

If the Gmail interface doesn't change then there's really nothing to worry about. Gmail will continue to work as always, but if Google makes a change that breaks Gmail in Chrome 49 that's too bad for you.

Where the hard choices come in is if Google does switch XP and Vista users to the HTML version of Gmail. That would mean moving back to the original Gmail interface, which is very basic. You'd also lose a number of useful features including chat, the spell checker, the ability to add or import contacts, rich formatting, customized From addresses, and keyboard shortcuts.

That's a pretty tall list of shortcomings, but if all you're looking for is the ability to write text, add attachments, and press Send, then the HTML version will meet your needs.

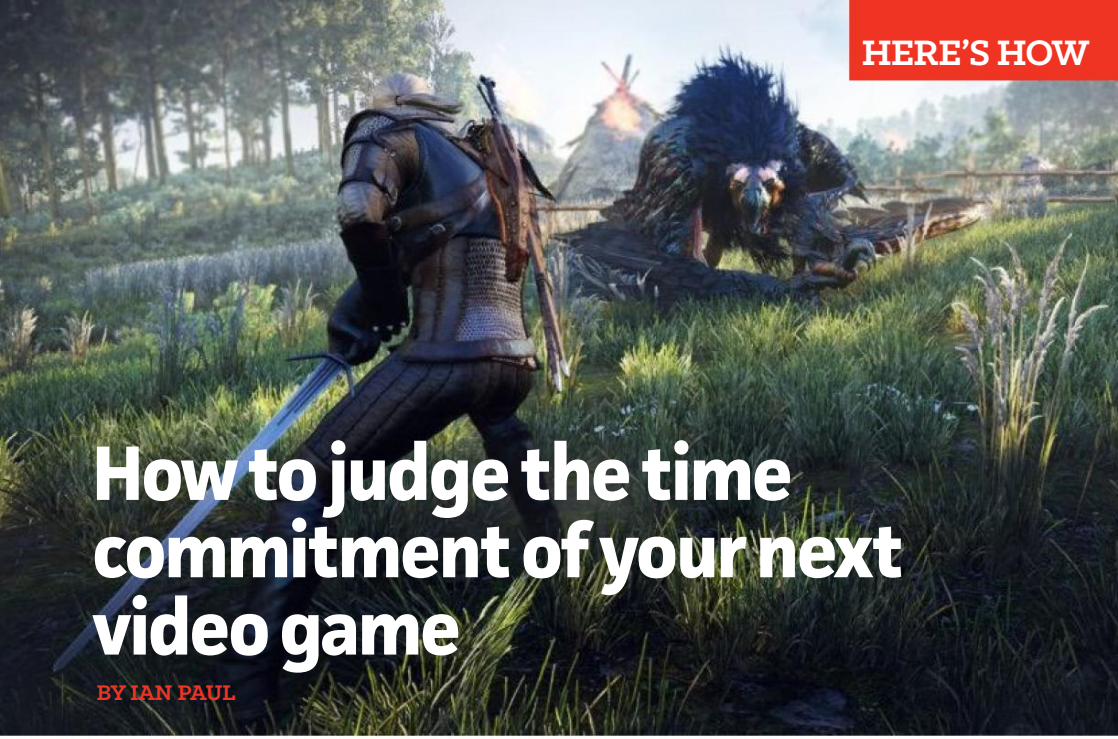
You'll miss out on chat, but if you're still using Google Talk, a third-party chat client such as Pidgin (pidgin.im/download) will cover that.

If the basic HTML version doesn't cut it for you, the best thing you can do is switch to a desktop program for email such as the built-in Outlook Express on XP. Or you can download Mozilla Thunderbird, which currently supports Windows XP with Service Pack 3 installed.

Thunderbird will give you pretty much everything that the HTML version of Gmail doesn't. The exception would be customized From addresses (aka aliases), which are dependent on Google. Though if you already have an alias in use, you can use it with Thunderbird.

If you don't know how to set up an email client, Mozilla has a simple tutorial (go.pcworld.com/tbgmail) on how to use Thunderbird with Gmail.

Of course, I'd be remiss if I didn't also mention that another alternative is to finally upgrade your operating system to Windows 10 or switch to Linux (go.pcworld.com/trylnx). But who am I kidding? If you haven't already switched after losing Google Drive, Chrome, and soon Firefox, then Gmail isn't going to persuade you either.



How to judge the time commitment of your next video game

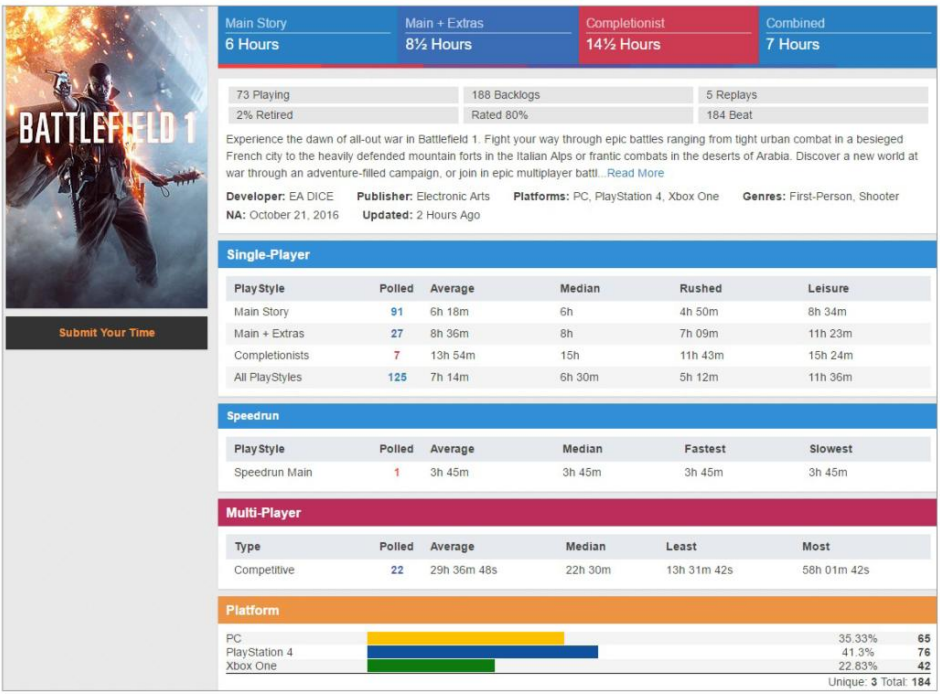
BY IAN PAUL

ONE OF THE most crucial skills for success is proper time management. It's vital that we use our time as effectively as possible. In that spirit, I offer a tip that will help you make some important decisions concerning the time you dedicate to the great pastime of playing video games.

Today's AAA titles vary wildly in the time they take to complete. You could spend more than a hundred hours getting through *The Witcher 3: The Wild Hunt* (go.pcworld.com/hltbwitch3) or less than a day on a game like *Resident Evil 7: Biohazard* (go.pcworld.com/hltbresid7).

The appeal of a game's size depends on your own personal preferences, and your interest in a particular game or series. Nevertheless, it's still valuable to know how much time a given game entails.

A site that can help you figure this out is HowLongToBeat.com (HLTB). As its name suggests, HLTB gives you the average time it takes players to complete a particular game. The site even breaks out different categories of completion.



The search results for *Battlefield 1* on HowLongToBeat.com.

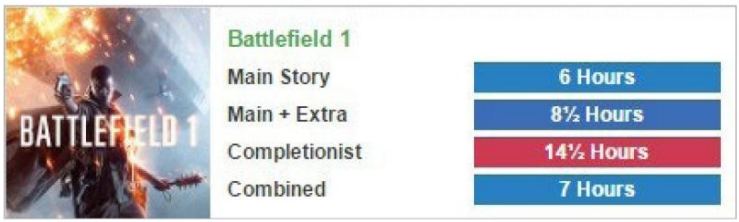
If you're someone who prefers to blast through the main story, HLTB gives you a sense of how quickly you can get the job done. If exploring every single corner of a game is your thing, you can find the average amount of time it takes to do that.

The site also has a bunch of extra features such as personal game tracking, comparing completion stats against your friends, and so on. If you're into that stuff, great—the site's playing-time estimates are based on user-contributed data.

In this look at the site we're going to focus on how HLTB can help you find the amount of time it takes to play a particular title. Keep in mind that HLTB's reliance on user data means it takes time before newer games show up in its database. That said, games tend to show up on the site fairly quickly.

Get started by clicking on Search at the top of the site's homepage.

Once you load it, the search section of the site automatically generates a list of games, with newer and more popular games at the top. At this writing, the site had more than 24,000 games in its database.



HLTB *Battlefield 1's* summary on HLTB.com.

Let's say you want to find out how long it will take to finish the campaign for *Battlefield 1* (go.pcworld.com/battle1). Search for the title on the site and it will appear at the top of the search results. Right here you can get a quick summary of the time you can expect to spend on the game: about 6 hours for the main story and 14.5 hours to complete everything.

You'll notice that each time estimate is color coded. These colors represent how confident the site is in each estimate. The more blue the estimate is, the more accurate it's supposed to be. If it's red, the site doesn't have a lot of confidence in its accuracy.

To dive deeper into the information you can click on the game title. Each game has a page like the one you see on the previous page. The time estimates are at the top, along with a synopsis. Below that you'll see all kinds of data about playing time such as how many players were polled for the various completion times, and the number of players from each platform that contributed data.

Just this one aspect of HLTB makes it a useful site that even casual PC gamers should bookmark to help make decisions about which games to play, and when.

How to switch to Chrome's Material Design settings page for an easier experience

GOOGLE IS STILL hard at work on developing its Material Design overhaul for Chrome on PCs. About a year ago, we looked at how you can activate Material Design for Chrome's settings page (go.pcworld.com/matdesign), and a few other parts of the browser. If you haven't made that switch yet, I'd suggest that now is a good time to do it.

A year ago, the Material Design look for the settings page was nice, but it wasn't anything to get excited about. That has since changed.

In my opinion, the Material Design look for the Chrome settings page now makes it much easier to view and understand the browser's various options. The actual wording of each setting hasn't changed much (if at all). The overall look, however, is much simpler and more organized.

To get started, type **`chrome://flags/#enable-md-settings`** into Chrome's address bar and hit Enter. The setting, entitled Enable Material Design Settings, should now be highlighted. Click the drop-down menu, which should currently say Default, and select Enabled. A Relaunch Now button will appear at the bottom of the page; click that

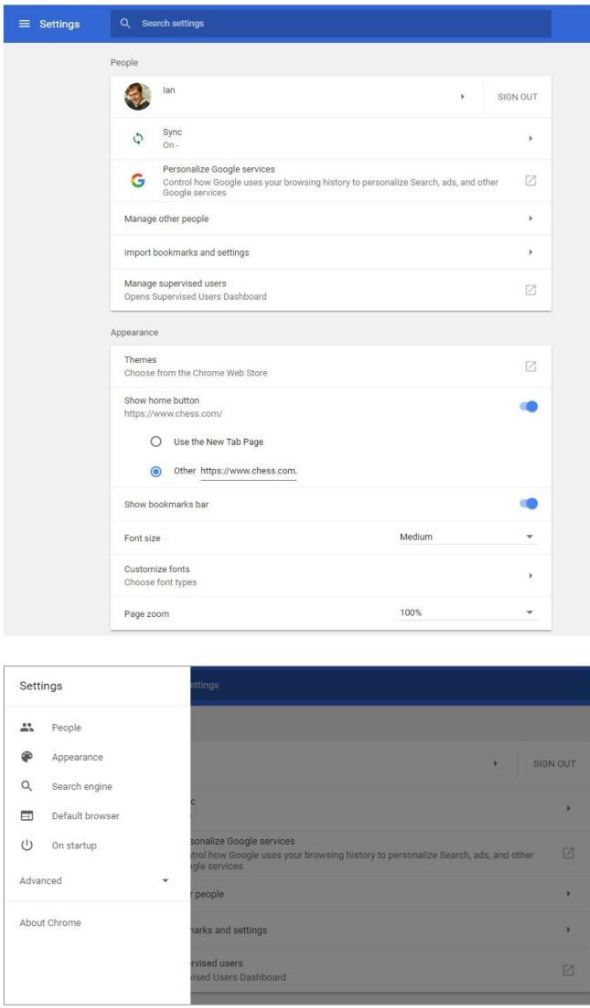
to restart the browser.

When Chrome comes back, click the menu icon in the upper right corner (the three vertical dots), and select Settings from the drop-down menu. The result should be what you see here, with an overall look similar to the Google Account settings page.

At the top of the settings page is a bold blue header with a "hamburger" menu icon on the left and a large, prominent search box at the top. Click the menu icon and a panel pops out from the left allowing you to navigate quickly to the major sections of Chrome's settings including the Advanced options.

The search box, meanwhile, is another way to quickly find what you're looking for. Type a query and the search results automatically generate as you type, allowing you to jump to any part of the settings menu.

If you prefer to look through the settings manually, below the blue header there is a single column of settings. The various options aren't all that different, but the new design makes it easier to read and understand what each setting does.



The Material Design settings page (top). The menu in Chrome's Material Design settings page (bottom).

If you're a regular Chrome user, it's well worth your time to enable the new look, and while you're at it try **`chrome://flags/#enable-md-extensions`** for an overhauled Extensions page.

Why you should cover up your laptop's webcam

AS IT HAPPENS a few high-profile folks have been spotted covering their webcams, including F.B.I. Director James Comey, who said in an interview, "I put a piece of tape over the camera. Because I saw somebody smarter than I am had a piece of tape over their camera." He was most likely referring to a photo Facebook's Mark Zuckerberg posted: In the background, his work laptop shows tape applied over the webcam above the display, and the dual mic on the left side.

Now, it's easy to imagine hackers wanting access to both the F.B.I. Director's laptop as well as Mark Zuckerberg's MacBook Pro, but would they want to access the webcam on a random person's computer? The answer is that hackers stand to profit the most if they can capture footage or audio to use for blackmail. It's unlikely they'll bother with

you unless you're someone who has a public profile to protect.

Based on what I've read about these types of attacks, the only way for hackers to access your webcam and turn it on without your knowledge would be for them to take over your computer first, which basically makes the entire scenario similar to any other type of remote attack. In the most likely scenario, you'd receive an email with an attachment that, once opened, would install RAT software on your machine, which stands for Remote Administration Tools. Also if you think you'd notice your webcam running because of an activity LED, think again.

If you think you'd notice your webcam running because of an activity LED, think again.

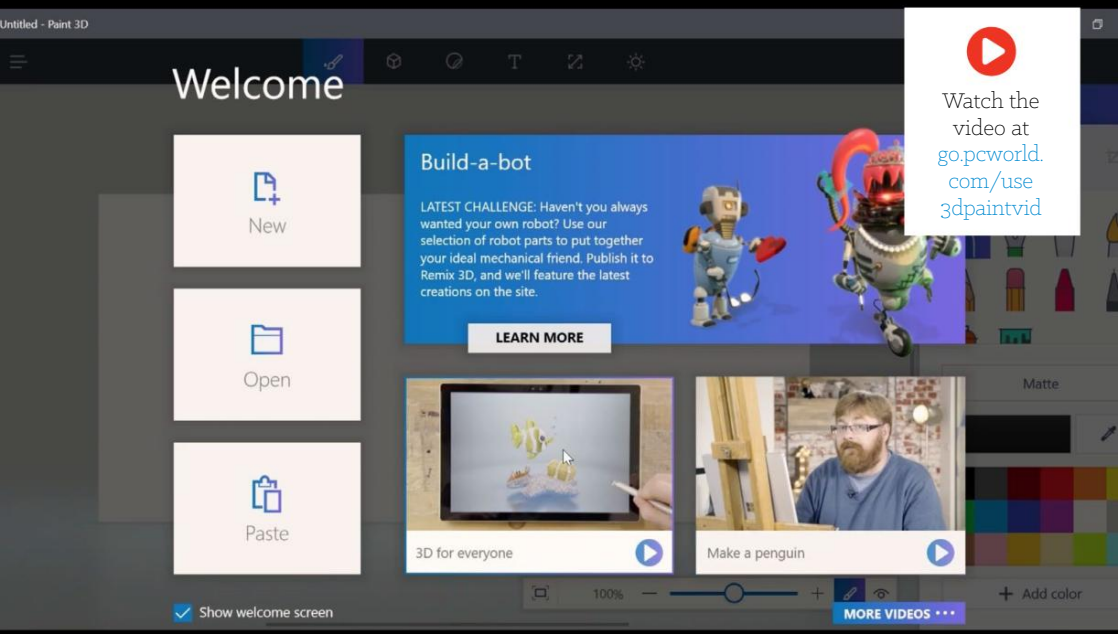
Based on all this, here is what I recommend:

- Close your laptop when you're not using it.
- Always keep all of your software up to date, especially your web browsers and all associated plug-ins, and especially Adobe Flash.
- Be sure your firewall is enabled at all times.
- Routinely check for malware, and always run anti-virus.
- As always, avoid clicking links in emails, even when you know the sender.
- If you want to be absolutely sure nobody is watching or listening to you, be like Zuck and cover your webcam and microphone with tape, a peel-off sticker, or something else that can obscure the lens but be removed easily when you actually want to use it.

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

Tech Spotlight

A video showcase of the latest trends



How to use **Microsoft's Paint 3D app**

» Goodbye Windows Paint, hello Paint 3D, which will debut with Windows 10's Creators Update. Its entire purpose is to create fun, cartoony 3D objects and scenes—and share them. A major part of Paint 3D's appeal is the Remix 3D community, where you and other members can import, edit, then share digital objects and ideas, taking from and providing inspiration to your fellow digital artists.